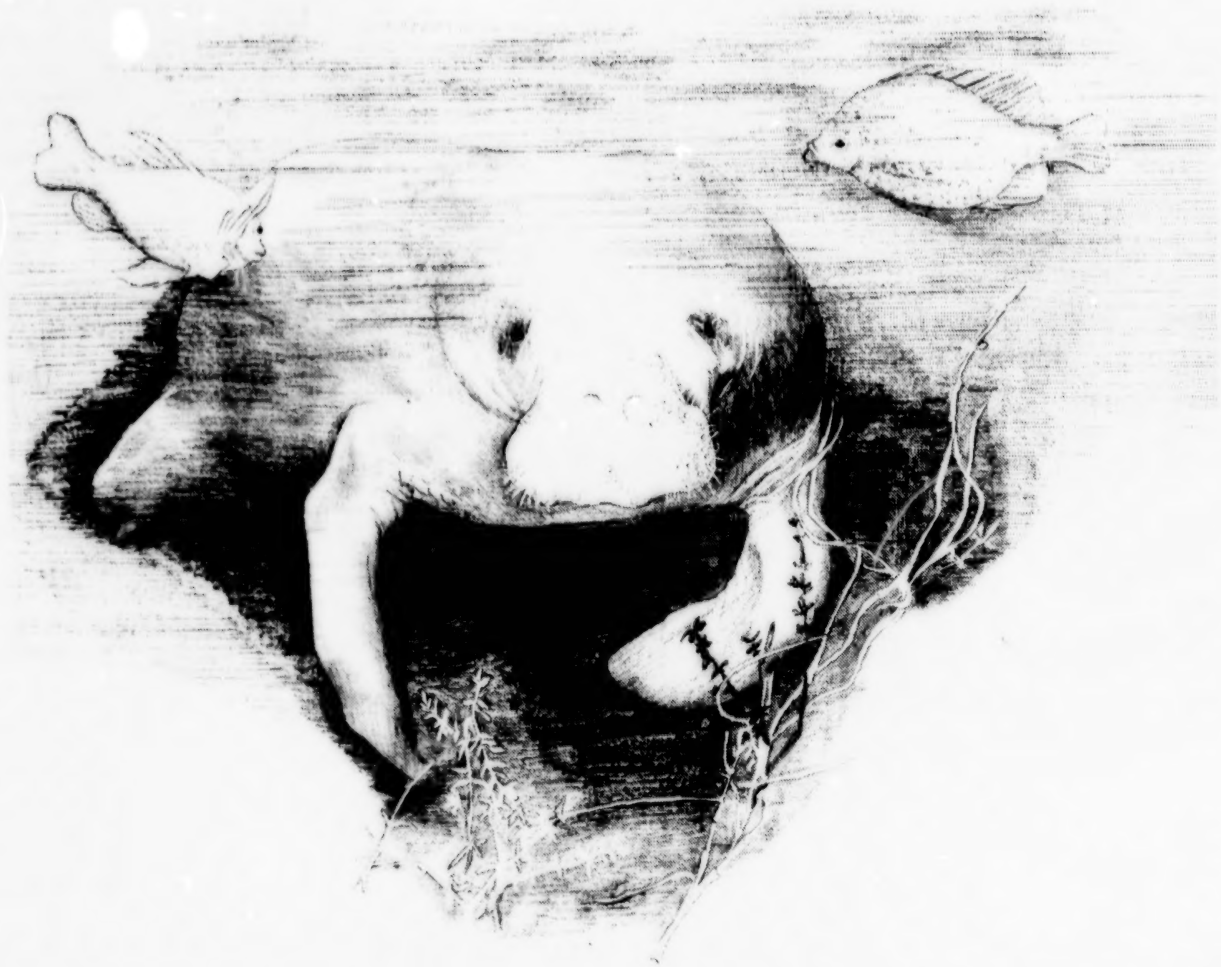


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FLORIDA MANATEE RECOVERY PLAN



Nf

COMPLETED

FLORIDA MANATEE RECOVERY PLAN

(Trichechus manatus latirostris)

REVISED RECOVERY PLAN
(Original Approval: April 15, 1980)

Prepared by

The Florida Manatee Recovery Team

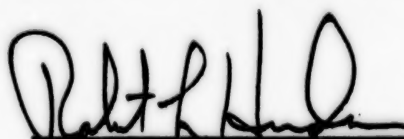
for

Southeast Region
U.S. Fish and Wildlife Service
Atlanta, Georgia

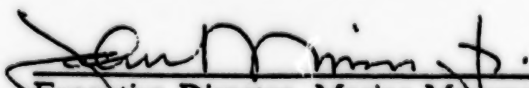
Approved:


Regional Director, U.S. Fish and Wildlife Service

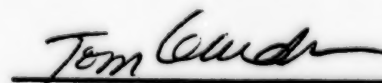
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Date: July 24, 1989

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South Florida Water Management District
Mote Marine Laboratory
Wildlife Management Institute
Aquatic Habitat Institute
National Wildlife Federation (Inc.)
Eckerd College
Tampa Bay Regional Planning Council
Southwest Florida Water Management District

This is the completed revision of the Florida Manatee Recovery Plan which was originally approved on April 15, 1980. It has been approved by the U.S. Fish and Wildlife Service. The plan has been prepared by the Florida Manatee Recovery Team to delineate reasonable actions believed required to place the assigned species in the best possible position for recovery. It does not necessarily represent the views of all individuals involved in the plan's formulation. It does not necessarily represent official positions or approvals of cooperating agencies. This plan is subject to modification as dictated by new findings, changes in species status, and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other constraints.

Literature Citation should read as follows:

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PREFACE

The original West Indian Manatee Recovery Plan, and its implementing document, the Comprehensive Work Plan, were approved by the Director, Fish and Wildlife Service, on April 15, 1980, and February 4, 1982, respectively. To improve the effectiveness of these documents, the Service has since prepared a separate recovery plan for the Puerto Rico population of the West Indian (or Antillean) manatee (*Trichechus manatus manatus*), and identified the need to revise and consolidate recovery and work planning tasks into a similar, separate document for the Florida manatee (*Trichechus manatus latirostris*) population.

The recovery plan for the Puerto Rico manatee population was approved by the Director on December 24, 1986, and in February 1988, the Fish and Wildlife Service reappointed the new multi-agency Florida Manatee Recovery Team to prepare a revised plan for the Florida population.

This revision was undertaken by the new Recovery Team, presently consisting of: John F. Adams, U.S. Army Corps of Engineers; Tom Beck, Florida Department of Community Affairs; Glenn A. Carowan, Jr., U.S. Fish and Wildlife Service; Kelly J. Custer, Florida Department of Environmental Regulation; James A. Farr, Florida Department of Community Affairs; R. Kipp Frohlich, Florida Department of Natural Resources; William E. Guy, Jr., Marine Industries Association of the Treasure Coast, Inc.; Judith Hancock, Sierra Club; Mike Harris, Georgia Department of Natural Resources; John T. Lowe, Marine Industries Association of Florida; Dr. Dan Odell, Sea World of Florida; Dr. Tom O'Shea, U.S. Fish and Wildlife Service; Patrick M. Rose, Florida Department of Natural Resources; Judith Delaney Vallee, Save the Manatee Club; David J. Wesley, U.S. Fish and Wildlife Service; and Dr. J. Ross Wilcox, Florida Power & Light Company.

The purpose of this revision is to update and refine the tasks presented in the original recovery and work plans, and to delineate new tasks that will be useful in manatee recovery efforts. This revised plan incorporates the new format that has become standard in recovery plans in recent years. It is intended to serve as a guide that delineates and schedules those actions believed necessary to restore the Florida manatee as a viable self-sustaining element of its ecosystem. It is recognized that some of the tasks described in the plan are well underway. The inclusion of these "in-progress" tasks represents an awareness of their importance, and offers support for their continuation.

The challenge of recovering the Florida population of the West Indian manatee is great. It will take a well-coordinated and cooperative effort from all local, State, and Federal agencies and the cooperation of private citizens and groups to prevent the species' extinction. With that in mind, the Florida Manatee Recovery Team has attempted to involve all responsible parties in the Recovery Plan. All recovery tasks, regardless of priority, are necessary, and are considered serious objectives for the recovery of the species. We hope to maintain a high level of coordination in order to bring about a successful implementation of the step-down outline which we believe can lead to the full recovery of the Florida manatee. It is imperative that we all work together toward this common goal, and that sufficient appropriations and staff are made available to the involved agencies to accomplish the identified recovery activities.

LIST OF ABBREVIATIONS

CARL	CONSERVATION AND RECREATION LANDS
COE	U.S. ARMY CORPS OF ENGINEERS
CRNWR	CRYSTAL RIVER NATIONAL WILDLIFE REFUGE
CZM	FLORIDA BUREAU OF COASTAL ZONE MANAGEMENT
DRI	DEVELOPMENT OF REGIONAL IMPACT
EPA	U.S. ENVIRONMENTAL PROTECTION AGENCY
ESA	ENDANGERED SPECIES ACT of 1973, AS AMENDED
FDCA	FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS
FDER	FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
FDNR	FLORIDA DEPARTMENT OF NATURAL RESOURCES
FGC	FLORIDA GAME AND FRESH WATER FISH COMMISSION
FMP	FLORIDA MARINE PATROL
FMSA	FLORIDA MANATEE SANCTUARY ACT
FPC	FLORIDA POWER CORPORATION
FPL	FLORIDA POWER & LIGHT COMPANY
FWS	U.S. FISH AND WILDLIFE SERVICE
GDNR	GEORGIA DEPARTMENT OF NATURAL RESOURCES
GIS	GEOGRAPHICAL INFORMATION SYSTEM
LPDA	LOCAL GOVERNMENT COMPREHENSIVE PLANNING AND LAND DEVELOPMENT REGULATION ACT
MFC	FLORIDA MARINE FISHERIES COMMISSION
MIA	MARINE INDUSTRIES ASSOCIATION OF FLORIDA
MMC	MARINE MAMMAL COMMISSION
MPP	MANATEE PROTECTION PLAN(S)

MMPA	MARINE MAMMAL PROTECTION ACT
NERC	NATIONAL ECOLOGY RESEARCH CENTER
NFWF	NATIONAL FISH AND WILDLIFE FOUNDATION
NPS	NATIONAL PARK SERVICE
NMFS	NATIONAL MARINE FISHERIES SERVICE
NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NWR	NATIONAL WILDLIFE REFUGE
OCM	OFFICE OF COASTAL MANAGEMENT
OFW	OUTSTANDING FLORIDA WATER
RPC(s)	REGIONAL PLANNING COUNCIL(S)
SCS	SOIL CONSERVATION SERVICE
SFWMD	SOUTH FLORIDA WATER MANAGEMENT DISTRICT
SMC	SAVE THE MANATEE CLUB
SOC	SAVE OUR COASTS
SWFWMD	SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
TECO	TAMPA ELECTRIC COMPANY
TIITF	FLORIDA'S TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND
TNC	THE NATURE CONSERVANCY
USCG	U.S. COAST GUARD
USDA	U.S. DEPARTMENT OF AGRICULTURE
USGS	U.S. GEOLOGICAL SURVEY
WMD(s)	FLORIDA WATER MANAGEMENT DISTRICT(S)

INTRODUCTION



I. INTRODUCTION

Historical Distribution

It is likely that peninsular Florida has always been the center of the range for *T. m. latirostris* in the southeastern United States. The historical northern winter boundary is believed to have been restricted to Florida south of Charlotte Harbor on the west coast and Sebastian River on the east coast (Moore, 1951) (Figure 1). In the summer, infrequent sightings have been verified as far north as Virginia and as far west as Louisiana, with frequent sightings in Georgia. A manatee recovered from Texas in 1986 provided the first opportunity in nearly 50 years (Gunter, 1942) to determine if manatees observed in Texas could be taxonomically grouped with the Florida subspecies. Examination of the skull by Domning, however, did not conclusively place the animal in either the Antillean or Florida population (O'Shea, 1988). Detailed discussions of manatee distribution in the southeastern United States can be found in O'Shea (1988), Powell and Rathbun (1984), Domning and Hayek (1986), Beeler and O'Shea (1988), and Lefebvre, et. al. (in press).

Taxonomy

The genus *Trichechus* is one of only two living genera of the mammalian order Sirenia, represented by three allopatric species: *T. senegalensis*, the West African manatee; *T. inunguis*, the Amazonian manatee; and *T. manatus*, the West Indian manatee. The other genus, *Dugong*, has only a single species, *D. dugon*, which is distributed throughout the Indopacific. All species are aquatic herbivores, and are considered threatened or endangered throughout their ranges by the U.S. Department of the Interior (Federal Register, July 22, 1985. Vol. 50 (140): 29900-29909).

The West Indian manatee is represented by two subspecies, the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). The Florida manatee was first described by Harlan in 1824 as *Manatus latirostris*. Later, Hatt (1934) recognized it as a subspecies of *Trichechus manatus* Linnaeus. Earlier workers questioned the validity of the subspecies of *Trichechus manatus* (Moore, 1951; Lowery, 1974). Domning and Hayek (1986), however, carefully examined specimens of this species, and based on several morphological characteristics, confirmed the existence of the two subspecies.

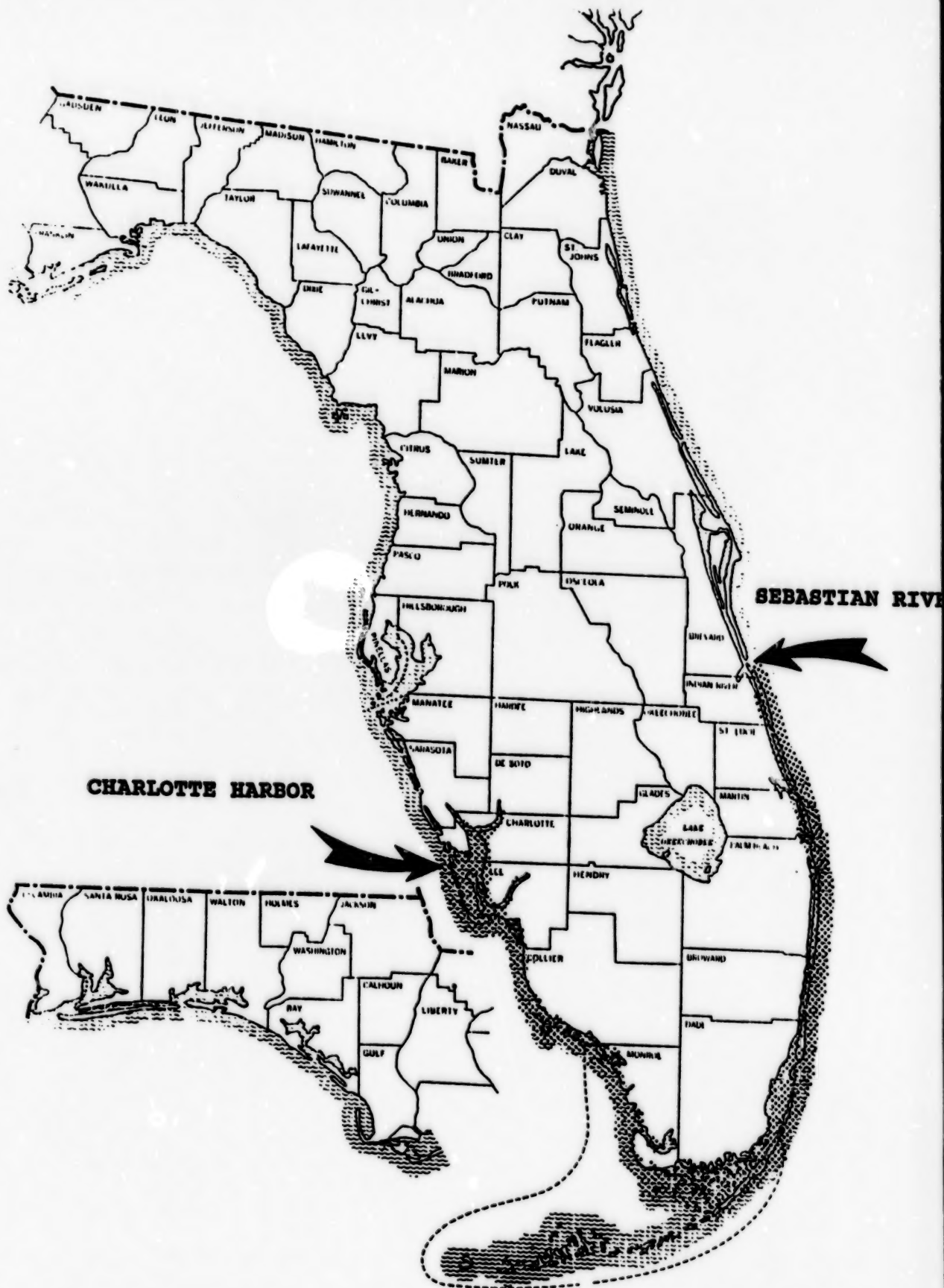


Fig. 1 The historical northern winter boundary of manatees in the southeastern United States extended from Charlotte Harbor on the west coast to Sebastian River on the east coast.

Description

The Florida manatee, like other members of its genus, is a massive, fusiform, thick skinned, nearly hairless, aquatic mammalian herbivore with paddle-like forelimbs, no hindlimbs, and a spatulate, horizontally flattened tail. Nostrils, located on the upper surface of the snout, are opened and closed by muscular valves as the manatee surfaces and dives below the water (Hartman, 1969; Husar, 1977). The eyes are very small, close with sphincter action, and are equipped with inner membranes that can be drawn across the eyeballs for protection (Husar, 1977). Eyelashes are absent. The upper lip is extremely flexible and permits manipulation of food into the mouth (Odell, 1982). The molars, designed for eating aquatic vegetation, are formed continuously at the back of the jaw and move forward as they wear down, possibly as an adaptation to eating abrasive vegetation mixed with sand (Odell, 1982). Bones are massive and heavy with no marrow cavities in the ribs or the long bones of the forelimbs (Odell, 1982). The gray skin is wrinkled with deep folds around the head, at the juncture of the flippers, and at the base of the tail (Phillips, 1964). The integument is from 8 to 16 mm (.32 to .64 in.) thick, and fine colorless hairs are sparsely distributed over the body (Barrett, 1935). Bristles are located on the upper and lower lip pads. The ears are minute, with no external pinnae. There are two axillary mammae at the base of the flippers (Husar, 1977). Large specimens can attain lengths of over 3.8 m (12.5 ft.) and weigh over 1,600 kg (3,500 lbs.), although most adults do not exceed 3.5 m (11.5 ft.) and 1,000 kg (2,200 lbs.) (Sirenia Project, U.S. Fish and Wildlife Service, unpublished data). Newborn calves range in length from 1.2 to 1.4 m (3.5 to 4 ft.) and weigh about 30 kg (66 lbs.) (Odell, 1982).

The subspecies, *T. m. manatus* and *T. m. latirostris*, are distinguishable by cranial characteristics, and can best be separated by width of the foramen magnum, shape of the palatal surface of the rostrum, and shape of the mandibular symphysis (Domning and Hayek, 1986). The biological basis for the subspecies distinction may be restricted gene flow resulting from ecological barriers of the cooler waters of the northern coast of Mexico and the swift currents of the Straits of Florida. These factors may combine to keep Florida manatees reproductively isolated from the remainder of the species' range (Domning and Hayek, 1986).

Habitat

Manatees¹ are most frequently found where aquatic vegetation is abundant in fresh or brackish waters of large slow-moving rivers, river mouths, and shallow, low

¹ The unmodified use of the word "manatees" hereafter always refers to *Trichechus manatus latirostris*.

energy coastal areas such as estuaries, coves, and bays. They can survive, however, in water that is salty, turbid or clear, acidic or alkaline (Hartman, 1971). Sensitive to low water temperatures (Hartman, 1979; Irvine, 1983), manatees predominately occur in tropical or subtropical waters. In winter months, they respond to declining water temperatures by aggregating at constant temperature springs and warm-water power plant or industrial effluents. Water depths of 1 to 3 m (approx. 3 to 9 ft.) are preferred, and currents stronger than 6 km/h (3.7 mph) are avoided (Husar, 1977).

Food

Manatees seem unselective in their choice of food, but prefer submergent, natant, rooted, and emergent vegetation, in that order (Allsopp, 1969; Hartman, 1971; Best, 1981). Succulent fresh water and estuarine aquatics are favored (Powell and Rathbun, 1984), but manatees have been observed to excavate the rhizomes and roots of marine spermatophytes (Packard, 1984), and to eat a wide variety of terrestrial plant parts that fall from vegetation overhanging water (Bengtson, 1981; O'Shea, 1986). Consult Best (1981), Ronald, et. al. (1978), and Ledder (1986) for lists of food plants consumed by both wild and captive manatees.

Manatees also consume algae when preferred vegetation is unavailable, and Hartman (1971) reported that *Oscillatoris*, *Enteromorpha*, *Navicula*, *Cladophora*, and *Spirogyra* were ingested by animals in Kings Bay, Crystal River, Florida when feeding on vascular aquatics. Hartman also reported that *Gracilaria* and *Ectocarpus* are consumed when manatees are feeding in estuarine waters.

Manatees spend 5 to 8 hours a day feeding, and consume 4 to 11 percent of their body weight daily (Bengtson, 1981; Etheridge, et al., 1985). Movements and aggregations of manatees, therefore, can be correlated to some degree with the distribution of seagrasses and vascular freshwater aquatic vegetation (Hartman, 1974).

Home Range and Movements

Manatees are non-territorial and have independent, overlapping, often identical ranges (Bengtson, 1981). In the southeastern United States, their range varies seasonally with migration (Moore, 1956). In summer, manatees range over large areas, move casually, pause for varying lengths of time in suitable habitats, and can cover perhaps 200 linear km (124 miles) or more of river or coastline. In winter months, many Florida manatees, responding to lower water and/or air temperatures, undertake a north-south migration and aggregate in groups around warm-water refugia during cold spells (Moore, 1951; Layne, 1965; Hartman, 1974; Irvine and Campbell, 1978; Rose and McCutcheon, 1980; Irvine, 1983; Shane, 1983; Kochman, et al., 1983; Powell and Rathbun, 1984; Reynolds and Wilcox, 1985 and 1986).

Diel patterns of movement, in and out of these winter concentration sites, have been documented (Bengtson, 1981; Kochman, et al., 1985), and a high rate of site fidelity for some of these warm-water refugia has been recorded (Powell and Rathbun, 1984; Rathbun, et al., in press).

Bengtson (1981) found that males range much wider than females, and Rathbun et al. (1983) documented long-distance movements of about 600 km (370 miles) by individuals in Florida. There have also been numerous recordings of northern extralimital sightings which suggest movements well over 600 km (Rathbun, et al., 1982; Powell and Rathbun, 1984).

Manatees along the Atlantic waterways readily move long distances, particularly where travel corridors are continuous (O'Shea, 1988), and when they are seeking warm-water refugia. For example, individuals in the upper St. Johns River in the late fall were resighted later at southeastern Florida aggregation sites 850 km (527 miles) away during the ensuing winter by FWS researchers from the NERC's Sirenia Project. Movements between wintering sites on the Gulf Coast from Charlotte Harbor north are suspected to be more restricted because of less suitable habitat between well-used areas (O'Shea, 1988), although one individual was reported by Powell and Rathbun (1984) to move from Crystal River south to Sanibel Island. Manatees apparently do not use Lake Okeechobee heavily, and movements from the Gulf Coast to the Atlantic Coast through the Okeechobee waterway have not been documented (O'Shea, 1988).

Population Estimate

Although significant efforts have been made to refine estimates of manatee population numbers and trends, estimates still cannot be made with any degree of sophistication. This is perplexing to many people. Furthermore, the basis for the estimates that have been made in the past are frequently misunderstood. In the following paragraphs historical efforts and problems are reviewed and clarified as presented by O'Shea (1988).

The first numbers, based on aerial surveys, were crude estimates provided by Hartman (1974). Hartman spent 151 hours searching for manatees by air over both Florida coasts, the Florida Keys, and the St. Johns River in summer 1973. The number of manatees seen (255) was assumed to be an underestimate of population size because of water clarity. Therefore, the number was adjusted upward using correction factors of 10, 50, or 90 percent for each of the three water clarity categories in the areas surveyed. Hartman (1974) then stated, "The total number of manatees in the United States is estimated between 750 and 850, with 1000 the conceivable maximum and 600 the conceivable minimum." This estimate had no statistical level of confidence associated with it, and estimates in subsequent years were not comparable because they were based on winter counts (rather than summer counts) without correction.

The second attempt to count manatees occurred in 1976, and took advantage of winter cold fronts to survey aggregation sites by air (Irvine and Campbell, 1978). Including observations from land at certain places, a total of 738 was counted. A workshop was convened in 1978 which reported that these data and a few subsequent counts "suggest a Florida population of at least 800 to 1000" (Brownell et al., 1981). This was a simple "minimum" estimate, but use of "at least" was subsequently misunderstood and interpreted as "only" or "about" in numerous quarters. This conservative minimum estimate was not designed for statistical accuracy or precision, and was misunderstood to be an accurate, precise census which revised Hartman's (1974) crude estimate upward.

In 1985, the minimum estimate was revised to 1200 by FDNR and FWS based on the summation of high counts obtained at various sites using standardized aerial survey techniques. It included the total of all high counts (866) from aerial surveys at power plants made under unusually cold and favorable counting conditions in January 1985 (Reynolds and Wilcox, 1986), plus totals at Tampa Bay sites (Weigle, et al., 1988), counts of 136 at Crystal River and 37 at Blue Spring, and estimated numbers in southern Florida not likely to have utilized areas subject to counting.

The 1985 revised estimate was likewise misunderstood by some as a population increase, but there was no evidence for or against a manatee population increase based on either of these three different estimates. In reality, the most recent revision of the minimum number reflected unusually good conditions for counting (including exceptionally cold weather), the lack of a statistically firm basis for estimating population size, and the continued misunderstanding that the previous estimate was something other than "at least" 800 to 1000.

The need continues to establish standardized population estimation techniques using aerial surveys or other methods, and to control or correct for the many variables (including temperature, observer bias, visibility, etc.) that affect aerial counts.

Social Interaction

Manatees do not form stable, close-knit social groups or herds (Hartman, 1979; Bengtson, 1981; Reynolds, 1981; Rathbun and O'Shea, 1984) and are essentially solitary animals (Hartman, 1979). In Florida, they are often seen in groups of two or more individuals, but these groupings are usually ephemeral (Husar, 1978) except when manatees aggregate at warm-water refugia during cold spells.

The only clearly evident social bond may be between a cow and her calf (Hartman, 1979). Bulls most often initiate social interactions, and are more social than females. Dominance by one manatee over another has not been observed. Play, in the form of "kissing," mouthing, embracing, nudging, bumping and chasing, is a pastime

indulged in by all animals irrespective of age or sex. Vocalization is noted in response to fear, sexual arousal, aggravation and play, but manatees are usually silent whether alone or in a group. Calls between a cow and her calf are more common, and vocalization probably plays a role in maintaining contacts between adults (Hartman, 1979).

Reproduction

Permanent breeding bonds between males and females are not formed, and receptive estrous females, while being pursued by a herd of males, will copulate quickly with several males in succession (Hartman, 1979). Courtship during estrus is very active, males constantly nuzzle and mouth the female, and sessions are often turbulent and protracted. Copulation usually occurs face-to-face and abdomen-to-abdomen under water with the male below, although side-to-side copulation in shallow water has also been reported (Hartman, 1979). Lasting from 15-30 seconds, copulation with the polyandrous female may be repeated at less than 1-minute intervals (Hartman, 1979).

Sexual maturity may be attained by males and females as early as 5 years of age (Odell, pers. comm.). Size is also an indicator of sexual maturity, and both sexes are considered to be reproductively capable at approximately 275 cm (approx. 9 ft.) (O'Shea et al., 1985). Recent data suggest that there is no well-defined breeding season. Females remain in estrus for about 2 weeks. Estimates for the gestation period is from 12 to 14 months (Hartman, 1979; Dekker, 1980; Cardeilhac, et al., 1984). The interval between births is 2 to 5 or more years, and births occur during all months of the year, although in northern Florida there may be a slight peak during summer. Parturition appears to occur most frequently in shallow, calm water. Litter size is normally one (Hartman, 1979), but twins are occasionally seen. Calves are usually weaned before 24 months of age, although a cow and calf may continue to associate for up to 4 years (Hartman, 1979). Adoption of orphaned calves and/or nursing of consecutive calves is rare, but has been observed (Hartman, 1979; Sirenia Project, U.S. Fish and Wildlife Service, unpublished data).

Little information exists on the manatee's life span, and therefore, it is impossible to predict how many calves a female could conceive during her lifetime. However, a captive female at Miami Seaquarium gave birth to 5 calves in 13 years, and 1 male has been in captivity for over 40 years. Dugongs have been known to live 50 to 60 years in the wild (Marsh, 1980).

Cold-Related Aggregations

Winter air temperatures of 10° to 15°C (50° F to 59° F) and water temperatures below 20° C (68° F) stimulate the formation of manatee aggregations at warm-water springs and power plant or industrial outfalls (Hartman, 1968). Twenty-five warm-water

refugia have been identified in Georgia and Florida; 6 natural springs and 19 artificial effluents (Figure 2) (Table 1).

Arrival at major aggregation sites usually begins in mid-November and ends in early March, but exact dates vary greatly with location of the refuge and weather patterns.

Present Status

Recent studies of manatee distribution in the southeastern United States and recent unpublished research findings associated with radio tracking and scar pattern identification by FWS's NERC Sirenia Project have greatly expanded the knowledge of manatee abundance, movements, distribution patterns, refugia, and important feeding areas within and outside Florida. (Consult Powell and Rathbun, 1984; Rathbun, et al., 1982; Rathbun, et al., in press; Reynolds and Wilcox, 1985 and 1986; Shane, 1984; Beeler and O'Shea, 1988; Lefebvre, et al., in press; and the MMC's report, "Preliminary Assessment of Habitat Protection Needs for West Indian Manatees on the East Coast of Florida and Georgia" for detailed descriptions.)

Current distribution of *T. m. latirostris* is confined primarily to Georgia and peninsular Florida. Extremes between summer and winter temperatures in the Southeast, however, result in different summer and winter season distributions (Moore, 1951; Hartman, 1974; Irvine and Campbell, 1978; and Rose and McCutcheon, 1980). During warm season months (April-October), manatees are dispersed throughout almost all coastal and estuarine waters of Florida and Georgia where aquatic vegetation is available (Figure 3) (Powell and Rathbun, 1984; Rathbun, et al., in press; Beeler and O'Shea, 1988; and others). During cold season months (November-March), manatees are restricted primarily to peninsular Florida south of Cumberland Island, Georgia on the eastern coast and the Suwannee River on the western coast (Rathbun, et al., 1982; Rathbun, et al., in press; and Beeler and O'Shea, 1988), and can be found in and around natural and artificial warm-water refugia (Figure 2) (Table 1). However, cold season distribution is not necessarily limited to these sites.



Fig. 2 General present mid-winter range (cross-hatching) of manatees in the southeastern United States. Locations of warm-water refugia correspond to sites numbered in Table 1.

TABLE 1
IMPORTANT WINTER REFUGIA IN THE SOUTHEASTERN UNITED STATES
(* - Major Sites with 25 or More Manatees)

EAST COAST:

1. Gilman Paper Company, Camden Co., GA
2. Container Corporation, Nassau Co., FL
3. Alton Box Board Factory, Duval Co., FL
4. J.D. Kennedy Generating Plant, Duval Co., FL
5. Southside Generating Plant, Duval Co., FL
6. Welaka Spring, Putnam Co., FL
7. Silver Glen Spring Run, Lake Co., FL
8. *Blue Spring Run, Volusia Co., FL
9. Turner Generating Plant, Volusia Co., FL
10. *OUC Indian River Power Plant, Brevard Co., FL
11. *Canaveral Power Plant, Brevard Co., FL
12. Vero Beach Power Plant, Indian River Co., FL
13. H.D. King Electric Station, St. Lucie Co., FL
14. *Riveria Power Plant, Palm Beach Co., FL
15. *Lauderdale Power Plant, Broward Co., FL
16. *Port Everglades Power Plant, Broward Co., FL

WEST COAST:

17. Manatee Springs, Levy Co., FL
18. *Crystal River Power Plant, Citrus Co., FL
19. *Crystal River/Kings Bay, Citrus Co., FL
20. *Homosassa River, Citrus Co., FL
21. *Big Bend Generating Plant, Hillsborough Co., FL
22. Gardinier Phosphate Plant, Hillsborough Co., FL
23. *Bartow Power Plant, Pinellas County, FL
24. *Ft. Myers Power Plant, Lee Co., FL
25. *Port of the Islands, Collier Co., FL

(Numbers correspond to locations on Figure 2)

NOTE: Winter manatee distribution is not totally confined to these major refugia. See the Introduction Section for additional information.

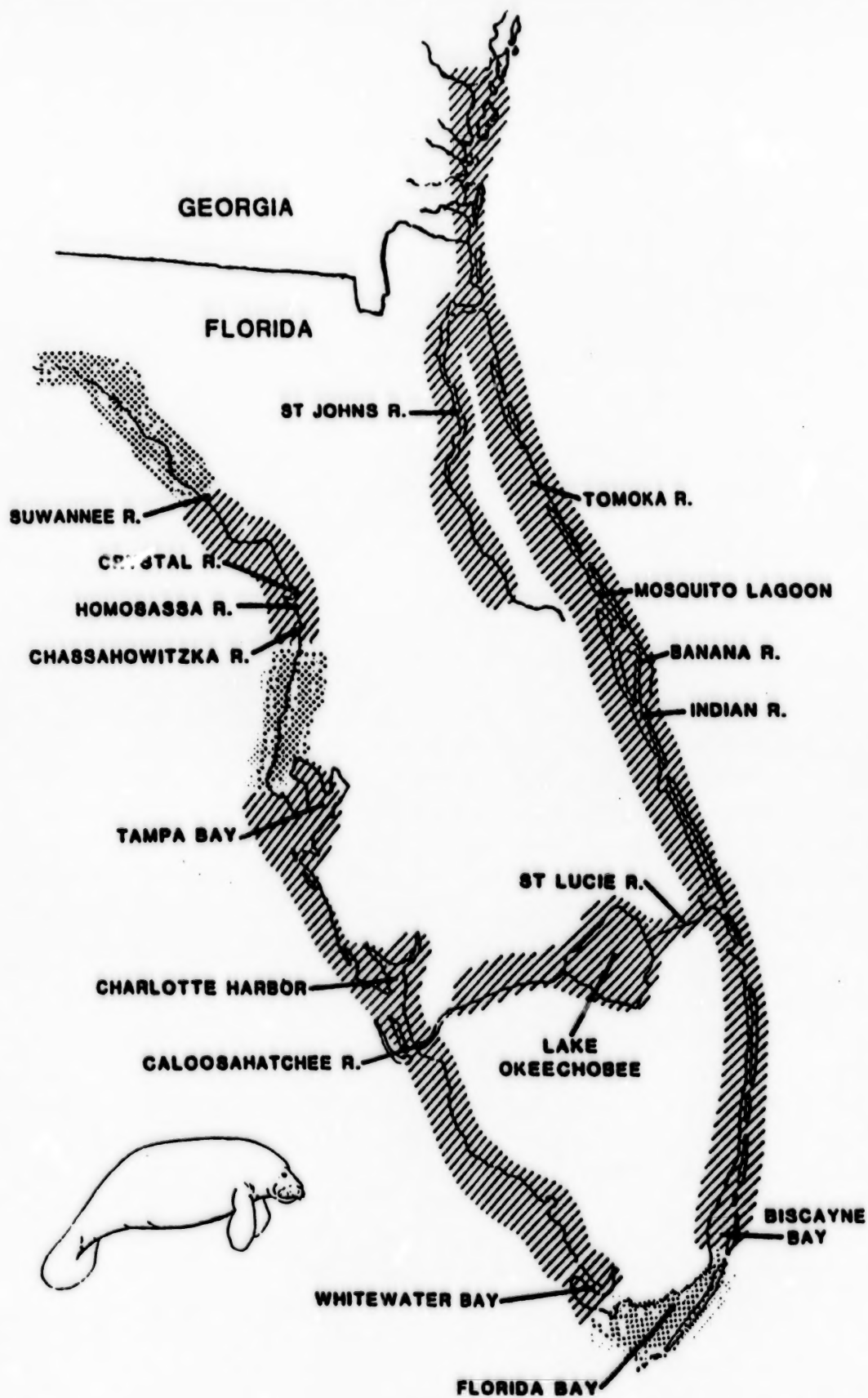


Fig. 3 General warm season distribution of manatees in the southeastern United States (cross-hatching). Areas where sightings are relatively rare are indicated with stippling. Sightings in states north of Georgia and west of Florida are uncommon (see text).

Extralimital sightings during the summer also occur in South Carolina, North Carolina, Virginia, panhandle Florida, Alabama, Mississippi, and Louisiana (Beeler and O'Shea, 1988; Rathbun, et. al., in press), and there has been an increase in the number of records of manatees in these states during the 1970's and 1980's (Powell and Rathbun, 1984). There is also evidence that the winter distribution of manatees has expanded northward from their historical range limits during the last 20 years. For example, significant numbers currently winter at power plant effluents on the Indian River near Titusville (Reynolds and Wilcox, 1986) and at Crystal River on the southern Big Bend coast; both areas are north of the historical winter limits defined by Moore (1951). This expansion has probably been due to the proliferation of artificial warm-water refuges, the spread of exotic aquatic vegetation, protection, and the development of a stronger conservation ethic since World War II (Powell and Rathbun, 1984; Rathbun, et. al., in press; O'Shea, 1988). Currently, results of aerial surveys suggest that about equal numbers of manatees inhabit the Gulf and Atlantic coasts.

Mortality

Since 1974, a well organized manatee carcass recovery program has existed to record, analyze, and report causes of manatee mortality in the southeastern United States (Table 2). Human-related mortality factors have been by far the greatest identifiable causes of manatee deaths. Of the 450 deaths classified as human-related in the Southeast through 1988, 336 deaths were attributed to boat/barge collisions, 69 were crushed/drowned in flood gates or canal locks, and 45 were due to other human-related deaths such as shooting, poaching, entrapment in fishing nets or lines, and vandalism. Large numbers of manatees have also died due to natural causes in Florida. Cold exposure caused many deaths during the winters of 1977, 1981, and 1984 when record low temperatures were recorded (O'Shea et al., 1985), and 42 manatees died in 1982 coincident with a red tide outbreak in southwest Florida (Buergelt et al., 1984; O'Shea, et al., 1985). Deaths categorized as "perinatal" and "natural" have totaled 243 and 172, respectively. Including the 522 deaths categorized as "undetermined", the total number of known deaths identified from all causes by the salvage/necropsy program from 1974 through 1988 has been 1,387. (It should be noted that data collected during the first 2 years of the salvage/necropsy program are less representative of subsequent reporting and recovery efforts, which have become more consistent since 1976. Therefore, the data represented in Table 2 from 1977 to present are used most frequently in publications and citations that record or compare manatee mortality figures.)

TABLE 2
KNOWN MANATEE MORTALITY IN THE SOUTHEASTERN UNITED STATES
BY YEAR AND DEATH CATEGORY

Year	Boat/ Barge	Gate/ Lock	Other Human	Perinatal	Natural	Undetermined plus V-NR*	Total
1974	3	0	2	0	0	3(1)	8(1)
1975	6	1	1	7	1	13	29
1976	10	4	0	14	2	32	62
1977	13	6	6(1)	9	1	80	115(1)
1978	21	9	1	10	3	42	86
1979	24	8	9	9	4	24(1)	78(1)
1980	16	8	2	13	7(2)	1*	65(2)
1981	24	2	4	13	9	65(2)	117(1)
1982	20	3	2(1)	14	41	37(2)	117(3)
1983	15	7	5	18	6	30	81
1984	34	3	1	26(1)	25(1)	41	130(2)
1985	35(2)	3	3	23	20(1)	39(1)	123(4)
1986	33	3	1	27	13	48(3)	125(3)
1987	39	5	4(2)	30	16	23(1)	117(3)
1988	43	7	4	30	24	26(1)	134(1)
Total	336(2)	69	45(4)	243(1)	172(4)	522(10)	1387(22)

() - Known manatee mortality outside of Florida

*V - NR signifies Verified-Not Recovered

(Table does not include manatee deaths from Puerto Rico)

A detailed record of manatee mortality in the southeastern United States can be found in Beeler and O'Shea (1988), and recent trends appear ominous. Well over 100 dead manatees have been recovered per year in 7 of the past 8 years, whereas this number exceeded 100 in only 1 of the previous 7 years.

Present Threats

Human activities, other than exploitation, are presently the major sources of threats to the Florida manatee. These activities directly or indirectly affect mortality, reproduction and recruitment, distribution and behavior, abundance and distribution of vegetation, the condition and availability of warm-water refugia, levels of contaminants and pathogens, and other vital physical, chemical, and biological processes of manatees and their habitat. These activities are discussed in greater detail below, without any attempt to place in priority order activities according to degree of impact.

1. Activities directly resulting in mortality and/or serious injury. The major causes of human-related mortality and serious injury include collisions with boats and other vessels, entrapment and crushing in flood control structures, entanglement in fishing gear, poaching, and vandalism. Some factors influencing boat/barge collisions include: Boat size and type; boat density; boat traffic patterns and their overlap with manatee travel and feeding areas; channel depth and configuration of water bodies; and marina, boat ramp, and docking facility siting.

2. Activities affecting reproduction and recruitment. Death of dependent calves (perinatal) is the second most prevalent category of manatee mortality, excluding the "undetermined" category. Reasons for these deaths require additional study and research. However, disturbance at birth, separation of mothers and calves by human harassment, death of the mother, and possibly pesticides are suspected as being contributing factors.

3. Activities that alter distribution and behavior. Harassment by unknowing and/or uncaring divers, snorkelers, fishermen, swimmers, and boaters often disrupts essential behavioral patterns including feeding and breeding. Such harassment can drive manatees away from warm-water areas into colder waters where they are more susceptible to disease or cold stress, and can alter local distribution. Dock, boat ramp and marina sitings and other forms of development can also impact manatee distribution and behavior.

4. Activities that directly and indirectly impact vegetation and water quality. Dredging and filling; construction of docks, piers, and seawalls; aquatic weed control; and boating activities such as bottom scraping, propeller scouring or anchor dragging directly destroy manatee food resources and indirectly impact aquatic vegetation by increasing turbidity, encouraging nutrient overloading, and reducing light penetration. Alteration of drainage patterns from wetlands and uplands, water draw-down from rivers, land development, and stormwater runoff also affect the chemical composition and quality of water and alter natural filtration processes. Water contaminants, associated with industrial and sewage treatment discharges, also impact water quality and vegetation.

5. Activities that increase contaminant and pathogen levels. To date, knowledge regarding the effects of contaminants and pathogens on manatees is incomplete. Manatees may be susceptible to a number of viruses and bacteria present in human and animal wastes, and to parasites transmitted through fecal material (Beck and Forrester, 1988). Identified sources include *Toxoplasma gondii*, a felid protozoan that was implicated in the death of one manatee (Buergelt and Bonde, 1983), and *Heterocheilus tunicatus*, a nematode common in manatees that may be transmitted by coprophagy. Heavy metals, organochlorine pesticides, polychlorinated biphenyls, petroleum products, and radioactive wastes are some of the more persistent

contaminants that could adversely affect manatees. Aquatic weed control activities, wastewater and industrial effluents, and agricultural and stormwater runoff are other sources of contaminants.

6. Activities that influence the condition and availability of warm-water refugia. Power-plant overhauls and shutdowns, alterations of industrial and power-plant cooling streams, water withdrawals from the aquifer, alteration of recharge areas, vessel traffic within warm-water discharge areas, restriction of physical access to refugia, and capping of natural springs are some threats which would seriously impact manatees. Reduced flow volume of natural springs, for example, could influence water quality which in turn would impact vegetative biomass and composition, particularly in such freshwater systems as Kings Bay and Crystal River. Reductions in spring flows or industrial discharges could also expose manatees to cold stress and diseases.

Accomplishments

Numerous recovery activities have been accomplished since the manatee was listed as an endangered species by State and Federal governments, and following the approval of the West Indian Manatee Recovery Plan and its implementing document, the Comprehensive Work Plan. The following is a summary of some of the most noteworthy manatee protection and recovery accomplishments, including information provided by Reynolds and Gluckman (1988) in their report to the MMC.

1. RESEARCH PROGRAMS AND STUDIES

(a) Manatee salvage and necropsy research: Since its inception in 1974, this program has provided valuable information on manatee biology, anatomy, phylogeny, and physiology, and on the locations, numbers, and causes of manatee deaths in Florida and elsewhere in the southeastern United States and Puerto Rico. Examinations of over 1,300 manatees between 1974 and 1988 have made it possible to identify the particular cause of death and to implement management and/or regulatory actions to reduce resultant mortality from that cause. For example, mortality due to water control structures was identified by this program, and provided the basis for implementing corrective measures. Likewise, the program has provided important information on boat/barge collisions, making it possible to identify areas where boat speeds should be regulated. In July 1985, FDNR assumed complete responsibility for the program from FWS, and continued to use standardized methodology and data collection to ensure consistency.

In addition to establishing a 24-hour "Manatee Hotline" for reporting injured, sick, distressed, or dead manatees, FDNR also added additional sites for necropsy.

(b) Rescue and rehabilitation research: Sea World and Miami Seaquarium have been authorized by FWS to capture and rehabilitate diseased and/or injured manatees. Over 53 manatees have been rescued by these two oceanaria with little or no compensation for their efforts. Some of the data that have been obtained from these manatees have provided increased understanding of manatee physiological ecology, osmoregulation, reproduction, captive breeding, endocrinology, and behavior, as well as improved clinical information and techniques. More recently, other facilities, including Homosassa Springs Nature World Attraction and Disney's Living Seas at Epcot Center, have also become involved with manatee rehabilitation and research.

(c) Population surveys and associated research: There have been many studies conducted to assess manatee distribution and abundance. These have been undertaken and/or supported by a variety of persons and institutions including FWS, COE, FDNR, FPL, FGC, NPS (Cumberland Island and Everglades National Parks), SMC, Sierra Club, Eckerd College, MIA, Mote Marine Laboratory, Audubon, and others. These studies have greatly benefited manatee recovery efforts by improving survey techniques and by establishing a long-term data base that has made it possible, for example, to determine and establish "critical habitats," establish minimal population estimates, approximate adult/calf ratios, and improve information on seasonal distribution, aggregation sites, migration patterns, and manatee responses to environmental change.

(d) Life history studies, telemetric research, and ecosystem studies: FWS's NERC Sirenia Project has been extremely active and productive in pioneering important research programs for determining essential data on manatee life histories, migration, and preferred habitats. The Sirenia Project's past and on-going behavioral studies have greatly improved the knowledge of manatee social interactions, reproductive parameters, habitat needs, movements, etc. Telemetric research, and particularly the innovative satellite tracking research, has provided valuable information on movements, high use areas, and significant habitats. Ecosystem studies, such as the Hobe Sound Seagrass Study being conducted jointly by the Sirenia Project with FDNR, SMC, and NMFS, are providing insight into the impacts of boat-induced turbidity on important feeding areas, and food habits studies have made it possible to better define food preferences and types. The Sirenia Project has also benefitted recovery efforts by continuing its role as advisor and facilitator, and by assisting other countries in sirenian research.

FDNR likewise has been extremely active in furthering research, management, and information needs by supporting and conducting telemetric studies, conducting distribution surveys, refining aerial survey techniques,

assessing human activities, and developing boating studies, marina siting plans, and growth management plans that can be combined with existing manatee distribution and habitat/ecosystem information into a geographical information system.

2. HABITAT PROTECTION

As with research, habitat acquisition and protection have involved a number of agencies and institutions including the State of Florida, the Federal government, and private organizations such as TNC. Since the early 1980's, much progress has been made to acquire in fee-title particularly important habitats such as the Crystal River and Lower Suwannee NWRs, and significant State acquisitions such as lands at the headwaters of the Homosassa River, the 1,749 acre Stoney Lane Tract on the Crystal River, the 719 acre Stark Tract adjacent to Blue Spring State Park, and the 68,000 acre Big Bend coastline project.

Two of the most important State land acquisition programs in Florida, the Conservation and Recreational Lands Program (CARL) and the Save Our Coasts Program (SOC) have made fee-title acquisition of these important coastal and riverine habitats possible. Approximately 28,500 acres of land adjacent to primary manatee habitat have been acquired by the CARL program, while approximately 25,000 acres have been acquired under SOC.

Subsequent to passing Florida's Manatee Sanctuary Act of 1978, the State established 21 manatee protection zones, including some no entry zones (Blue Spring State Park and TECO). FWS established three inviolate sanctuaries in Kings Bay, and manatee protection zones on the Chassahowitzka and Merritt Island NWRs. Additionally, the State of Florida's TIITF designated 34 coastal estuarine areas as aquatic preserves, and FDER strengthened the protection afforded these areas by classifying them as OFWs. The MMC, in an effort to provide a basis for developing a region-wide network of protected manatee habitats, prepared reports on habitat protection needs in the Crystal River area and the East Coast, and supported acquisition efforts by FWS, FDNR, TNC, and other groups and agencies.

Comprehensive area-specific plans, such as the Research/Management Plan for Crystal River Manatees, and the MPPs that are being developed for Brevard, Citrus, Lee and other coastal counties also have been and will continue to be extremely important in protecting and safeguarding important manatee habitat.

3. GROWTH MANAGEMENT ACTIVITIES

In terms of conservation, possibly one of the most important pieces of legislation enacted by the State of Florida was the Local Government Comprehensive Planning and Land Development Regulation Act (LPDA) of 1985. The LPDA mandated that planners consider water quality; conservation, use, and protection of wildlife and marine habitats; protection of native vegetation; and restriction of activities adverse to threatened or endangered wildlife when developing county and local comprehensive development plans. These plans are due no later than July, 1991. The enactment of the LPDA therefore made it mandatory for growth management plans to address impacts to manatees and their habitats. It also made it possible to involve local Florida governments in the development of MPPs that would, among other things, control siting of marinas, boat ramps, and dry storage facilities; regulate shoreline use and development; and protect important manatee habitats.

4. REGULATORY, PERMITTING, AND ENFORCEMENT ACTIVITIES

Two Federal agencies, FWS and COE, and five state agencies, FDNR, GDNR, FDER, FDCA, and FGC have been actively involved in addressing the problems of manatee protection and conservation by reviewing proposed dredge-and-fill activities and construction projects in waters of the United States where projects may jeopardize manatees or their habitats. In addition to reviewing permit activities in waters of the United States pursuant to the Rivers and Harbor Act of 1899, the Clean Water Act, the Fish and Wildlife Coordination Act, and other related Federal laws, FWS and COE have responsibilities for protecting manatees and their habitats through the Section 7 consultation processes of the Endangered Species Act of 1973, as amended. In 1987, for example, the Service completed 337 Section 7 consultations with the Corps on construction projects in Florida. Of the 190 cases involving manatees, 84 decisions resulted in non-jeopardy biological opinions, 15 were jeopardy opinions, and 91 were "no effect" (Wesley, 1987).

Participation by the State of Florida and local agencies in manatee issues has been expanded. FDNR's Marine Research Institute is responsible for review of development projects, with the goal of protecting manatees and their habitats. The Institute continually makes recommendations to the TIITF and to FDER's permitting staff regarding projects which potentially affect manatees. The Henderson Wetlands Protection Act, which became effective on October 1, 1984, requires FDER to consider adverse effects to endangered or threatened species or their habitats in its review of dredge and fill permit applications. Projects which are considered to have adverse effects on manatees may be denied or may include stringent permit conditions for manatee protection. FDCA and

RPCs are responsive to manatee issues by monitoring dock and marina sitings, and in their review of projects which have regional impacts on State resources. In the future, FDCA will also be responsible for review and approval of local growth management plans.

Knowledgeable and active participation by law enforcement officers of the FMP, the FWS's Division of Law Enforcement, the USCG, FGC, and FWS wildlife officers assigned to NWRs has been crucial to the success of many manatee programs, and particularly to enforcement of sanctuary and boat speed zone regulations.

5. EDUCATION AND PUBLIC AWARENESS

In addition to Federal, State, and local government efforts, numerous private organizations and groups have undertaken a wide range of public awareness and educational activities including, but not limited to, the following:

- Distributing materials directly to the public, such as bumper stickers and brochures, and posting signs along waterways to inform boaters of the presence of manatees and boat speed regulations. FPL, for example, has produced a variety of educational materials, and as of July 1987, distributed as a public service about 219,000 booklets entitled "Boaters Guide to Manatees"; 160,000 booklets entitle "West Indian Manatee in Florida"; and 240,000 bumper stickers. SMC also produced 2,000 non-regulatory "Caution - Manatee Area" signs, published a variety of educational materials, and greatly improved public awareness of the plight of the manatee.

- Publicizing upcoming events and providing information on particular hazards to manatees. The Manatee Alert program, for example, was started in 1988 to advise the public of current manatee sightings in various waterways.

- Producing television documentaries and public service announcements about manatees in Florida, and distributing copies to schools and groups at no charge. For example, "Silent Sirens: Manatees in Peril" was produced by FPL, Audubon Society, and FDNR, and has been viewed by millions of people.

- Producing a limited edition series of high quality black and white drawings of manatees in numbered sets, the proceeds from which were donated to manatee protection (FPL).

- Publishing materials specifically for divers emphasizing what does and does not constitute harassment of manatees.

-Developing workshops to educate teachers and the general public. Workshops conducted by FPL from 1977 through July 1987, for example, have been attended by approximately 16,000 people.

-Publicizing radio tracking research. GDNR, for example, has printed and distributed posters at marinas, boat ramps, fish houses, sporting goods stores, and boating shops to inform the public of these research activities and reporting procedures to follow if an animal wearing a transmitter is sighted.

-Providing general interpretation and education. TECO's observation platform and CEE's posters for boat ramp projects are examples.

FDNR has spent over \$100,000 on educational and public awareness programs, and FWS, primarily through its Division of Refuges, has spent between \$40,000 and \$50,000 on specific manatee publications. In 1988, FWS committed \$650,000 for the acquisition of a site at Crystal River for the subsequent development of a manatee interpretive/education center, and the State of Florida purchased the Homosassa Nature World Attraction.

Oceanaria, in addition to supporting research, have also been extremely active in developing educational and public awareness programs. Sea World, for example, gave tours of their manatee rehabilitation facility to approximately 122,000 people between February 1987 and February 1988. Disney's Living Seas at Epcot Center has recently become involved in manatee education, and will be developing a comprehensive educational program in the near future. Miami Seaquarium's work with captive manatees and rehabilitation has also been well publicized and has benefitted public education and awareness.

RECOVERY



II. RECOVERY

A. Objective

The long range recovery goal for the Florida manatee, as required by the Marine Mammal Protection Act of 1972, will be to maintain "the health and stability of the marine ecosystem" and to determine and maintain their numbers at "optimum sustainable population" levels in the southeastern United States. As an interim objective to reach this goal, this plan seeks to down-list Florida manatees from "endangered" to "threatened" pursuant to the provisions of the Endangered Species Act of 1973, as amended. To achieve this objective, it will be necessary to establish and maintain a viable, self-sustaining population of manatees on both the Atlantic and Gulf coasts. The most effective way to reach this goal is to reduce mortality and injury; ensure the continued existence of suitable habitat, upgrading where possible; minimize harassment; and monitor the status of manatee populations and their habitats. A viable population level will be determined when appropriate methodology and data are available to develop adequate population models. Downlisting should be considered when population modeling indicates that the population is growing or is stable, when mortality factors are controlled at acceptable levels or are decreasing, and when habitats are secure and threats are controlled or are decreasing.

B. Stepdown Outline

1. Minimize injury and mortality to manatees, and better understand causes of natural mortality.
 11. Determine causes of injury and mortality.
 111. Insure the long-term maintenance and improvement of the salvage and necropsy program.
 112. Maintain and improve the reporting system.
 113. Determine causes of natural mortality and implement actions to reduce susceptibility to death from these causes.
 12. Minimize water vessel collisions with manatees.
 121. Identify/investigate areas of greatest boat/barge mortality and/or injury to improve understanding of specific problems.
 122. Develop and implement specific solutions to actual and potential boat/barge mortality and injury in particular areas.

- 1221. Develop site-specific interagency manatee protection plans at the local government level.
 - 1222. Establish, post signs for, and enforce local/State/Federal boat traffic regulations in areas where boats and manatees are most likely to encounter each other.
 - 1223. Evaluate feasibility of manatee protection devices for the class(es) of vessels identified as the causes of most propeller-related manatee mortality.
 - 1224. Evaluate feasibility of additional methods to minimize boat/barge mortality.
 - 1225. Conduct review of permitting procedures and criteria, and utilize Section 7 consultation process to minimize potential impacts to manatees and manatee habitats.
13. Minimize manatee mortality caused by water control structures.
- 131. Investigate specific cases of structure-related mortality and determine types of problem structures.
 - 132. Inform responsible agencies of problems and gain support for solving problems.
 - 1321. Conduct site-specific structure-related mortality studies.
 - 13211. For navigation structures, floodgates, culverts and other structures, test and implement alternative operational techniques and/or structural modifications and evaluate effectiveness of modifications.
14. Minimize other sources of human-related manatee mortality and injury.
- 141. Identify the extent to which other fishing apparatus (including crab traps, buoy lines, nets, shrimp nets, trotlines, other monofilament lines, and hooks), poaching, and vandalism are a problem and develop solutions.
 - 142. Monitor levels of contaminants in manatee tissues.
15. Rescue and rehabilitate distressed manatees.
- 151. Develop/refine rescue contingency plans for single and catastrophic events.

- 152. Develop safe and effective methods of capturing distressed manatees in open water situations.
- 153. Develop criteria for release of rehabilitated manatees.
- 154. Develop consultation arrangements with utilities, paper companies, and other industries that produce warm-water outfalls to identify plans (e.g., retirement of generating units, scheduled shutdowns, and movement of outfall locations) that could adversely affect the availability of these warm-water sources for manatees.
- 16. Evaluate effectiveness of current and future regulations and enforcement efforts, including the evaluation of and need for modified or expanded legislative authority.
 - 161. Conduct law enforcement workshops/training sessions.
 - 162. Standardize fines, work with court systems, and educate judiciary system.
 - 163. Evaluate extent of poaching and implement measures to apprehend violators.
- 17. Conduct programs to inform and educate the public, including tourists, and encourage development of educational programs with other countries to protect manatees.
 - 171. Expand educational and informational activities, and improve public awareness.
 - 172. Conduct public information survey to evaluate effectiveness of current informational/educational programs and modify accordingly.
 - 173. Expand boater and diver educational programs and target specific information to these groups.
 - 174. Continue posting and maintaining areas presenting greatest threat to manatees.
- 18. Develop bilateral or multilateral agreements with other countries for manatee conservation and research.
- 2. Ensure existence of suitable habitat.
 - 21. Identify habitat requirements and areas of special significance to manatees, emphasizing the use of state-of-the-art tracking technology.

- 211. Determine routes of movement and location of primary feeding, breeding, and resting areas of manatees.
- 212. Determine food preferences, dietary requirements, and nutritional requirements of manatees.
- 22. Characterize and identify threats to areas of special significance to manatees.
 - 221. Develop standard methods for characterizing, mapping, and monitoring important manatee habitats.
 - 222. Characterize and map important manatee habitats.
 - 2221. Evaluate desirability of modifying "Critical Habitat" designations, and make changes as necessary.
 - 223. Identify and evaluate potential threats to important manatee habitats.
 - 2231. Evaluate effects of boat traffic.
 - 2232. Evaluate effects of marina, dock and boat ramp construction, shoreline restoration/stabilization, and maintenance of navigational channels.
 - 2233. Evaluate effects of urban development, dredging and filling, and other development projects.
 - 2234. Evaluate effects of point and non-point sources of pollution, aquatic weed control, and other activities affecting vegetation and water quality.
 - 2235. Evaluate use of water resources affecting the function of natural spring aggregation sites in Florida.
 - 2236. Evaluate industrial discharges used as warm-water refugia by manatees.
- 23. Protect and monitor areas of special significance to manatees.
 - 231. Expand and increase number of state and Federal refuges, reserves, preserves, parks, and management areas in or adjacent to essential manatee habitats.
 - 232. Provide for protection of manatees in management plans for Federal and state systems of protected areas.

- 233. Designate additional areas as "Critical Habitat."
- 234. Establish and expand a network of manatee "reserves" and protected connecting travel corridors.
- 235. Protect and monitor quality and quantity of water flowing from natural springs in Florida.
- 236. Protect the integrity of artificial industrial effluents as important winter habitat.
- 237. Protect and maintain integrity of coastal ecosystems that support manatee habitats.
- 238. Maintain, protect, and monitor water quality and vegetation.
- 239. Properly locate boating facilities and navigational channels.
- 240. Monitor permit requests under Section 7 of the ESA for developments in manatee habitats.
- 24. Determine desirability and feasibility of managing and/or developing habitats for enhancing use by manatees.
- 3. Minimize harassment of manatees.
 - 31. Evaluate extent and minimize effects of harassment on manatees.
 - 311. Minimize manatee harassment/disturbance by boat and barge traffic.
 - 312. Minimize harassment by divers and swimmers.
 - 313. Minimize harassment by fishing-related activities.
 - 314. Evaluate effectiveness of and expand educational programs, regulations, and enforcement efforts for reducing all forms of harassment, and modify accordingly.
- 4. Determine and monitor status of manatee populations.
 - 41. Continue to utilize aerial survey and radio tracking techniques to monitor general patterns of distribution and relative abundance in geographical regions of special concern.
 - 411. Designate a working group from among those currently conducting or supervising aerial surveys using existing methodology.

- 412. Convene an annual meeting of the working group to discuss problems, review existing data, and evaluate current population status.
- 42. Refine methods to monitor status of manatee populations.
 - 421. Continue development and evaluation of aerial survey methods for estimating or indexing manatee abundance in survey/management areas, and ultimately Statewide.
 - 422. Further evaluate feasibility of utilizing mark/recapture methodology for population estimates.
- 43. Determine aspects of life history and ecology.
 - 431. Continue assessment of the vital parameters (size, age/sex structure, age-specific survival and reproductive rates) of manatee populations in: (a) Crystal River, (b) Blue Spring, and (c) other areas as identified.
 - 432. Utilize population modeling to develop insights into the relative importance of various life history parameters in the manatee's population dynamics.
 - 433. Expand assessment of manatee population genetics (i.e. variability, minimum population size, local genetic structures of populations, etc.).
 - 434. Continue development and evaluation of age determination techniques.
 - 435. Continue long-term studies of social structure and behavior, emphasizing the use of radio telemetry.
 - 436. Conduct bio-telemetry or other studies with captive and/or free ranging manatees to determine physical, physiological and metabolic response to changes in water temperature, harassment, salinity, and other variables.
- 44. Maintain and expand captive research programs with associated support facilities.
- 5. Coordinate implementation of recovery activities, monitor and evaluate progress, and update/revise the Recovery Plan.

51. Maintain State and Federal manatee coordinator staff positions.
52. Maintain the Florida Manatee Recovery Team and FDNR's Manatee Technical Advisory Council.
53. Update the Florida Manatee Recovery Plan.
54. Develop annual work plans.
541. Publish an annual report on the previous year's accomplishments, including a detailed account of agency expenditures for manatee protection.

C. Narrative

1. Minimize injury and mortality to manatees, and better understand causes of natural mortality.

The causes of known manatee mortality (Table 2) are categorized by the salvage/necropsy program as "human-related," "natural," and "undetermined." These three major categories are further subdivided to distinguish between the specific types or causes of death. The "human-related" categories include identifiable causes of death associated with "boat/barge collisions" (e.g. impacts with boat hulls, crushing, or propeller strikes); "crushing/drowning in flood gates or canal locks"; and "other human" activities (e.g. entanglement in fishing gear, ingestion of plastics, poaching, or vandalism). The "natural" category includes perinatal deaths (deaths of animals less than 150 cm (4 ft. 10 in.) in length for which a cause of death can not be identified), and "other natural" deaths (identifiable deaths from disease, cold stress, heart failure, etc.). The "undetermined" category includes cases that were verified dead but not recovered, were recovered with no recognizable cause of death, or were recovered in such an advanced state of decomposition that the cause of death could not be determined.

The human-related mortality categories continue to be the greatest identifiable causes of manatee deaths in the southeastern United States. Since 1980, between 26 and 54 manatees have been killed annually by boat/barge collisions, propeller strikes, entrapment in water control structures, entanglement in fishing gear, poaching, vandalism, and other human-related activities. Despite the promulgation and enactment of additional laws and regulations and implementation of a variety of management actions, human-related mortality has increased from an average of approximately 30 each year from 1979 through 1983, to an average of approximately 37 annually from 1984 through 1988.

Perinatal deaths have increased from an average of approximately 13 per year to an average of approximately 27 per year during respective time periods. Deaths in the "other natural" and "undetermined" categories, however, have been more consistent during these periods, yet deaths in these categories have averaged approximately 18 and 38 annually during the past four years, respectively.

Injuries have also continued to be a problem as evidenced by propeller scars and gashes, which are visible on a majority of manatees, and by mangled flippers resulting from entanglement in crab trap or fishing lines. Such injuries may cause the indirect death of some animals, particularly

dependent calves. For example, serious injuries to a female could impair abilities to care for offspring or could result in abortion of the fetus.

The following actions must be taken to reduce and/or eliminate mortality and injury.

11. Determine causes of injury and mortality.

The manatee salvage and necropsy program has been critical to documenting causes and locations of manatee mortality. It has provided important information on general biology, reproduction, population structure, aging techniques, food habits, genetics, diseases, parasites and contaminants. Information from this program has also been fundamental to the Section 7 consultation process, and for identifying needs for boat speed regulatory zones. However, almost 60 percent of all deaths have been categorized in the "perinatal" and "undetermined" categories where the cause of death could not be determined. FDNR will continue the program, and will make improvements to better determine causes of death.

111. Insure the long-term maintenance and improvement of the salvage and necropsy program.

Although the salvage and necropsy program has steadily improved over the years, support to FDNR will be improved, increased funding will be provided, and FDNR will hire additional staff for coordination of the salvage/necropsy program, including processing and examining specimens. These improvements will ensure that salvage/necropsy efforts are centralized and consistently performed, and that personnel are properly equipped with the necessary field equipment, training, base necropsy facilities in appropriate geographical locations, and support to maximize salvage/necropsy efforts, perform comprehensive necropsies, and properly preserve specimens and samples. The salvage program will continue to collect and preserve specimens, and encourage their use for research by qualified researchers. FDNR will continue its efforts to reduce the number of manatee deaths being diagnosed as "undetermined." (See Task 113.) To manage and properly analyze the large amount of current and historical information that is obtained and reported by the salvage/necropsy program, FDNR will incorporate relevant

mortality data into its GIS data base by 1990. This information will be maintained on a monthly basis, and will be available to local, State, and Federal agencies, resource and community planners, and developers, the media and others. The information network will be evaluated every two years by FDNR to determine if information needs are being met.

FWS, FDNR, and GDNR will review salvage/necropsy efforts for manatees recovered in Georgia, and will improve or develop reporting/recovery/necropsy procedures as necessary.

112. Maintain and improve the reporting system.

The toll-free hotline, which was established to provide 24-hour, statewide reporting of injured or dead manatees in Florida, and the mechanics for responding to these reports will be maintained by FDNR. Florida's reporting system will be improved by continuing public education and awareness, providing shorter response time, motivating field personnel, and periodically reviewing and monitoring the program's effectiveness to insure maximum benefit to the salvage and rescue/rehabilitation efforts. Examples of methods that will be used to make improvements include installing an automated priority answering system and regular training for dispatchers.

Similar improvements will be made in the reporting system for animals recovered in Georgia. GDNR will cooperate with FWS and FDNR in evaluating current reporting procedures, and will make improvements to insure expedient reporting and recovery of dead animals.

113. Determine causes of natural mortality and implement actions to reduce susceptibility to death from these causes.

Although direct human-caused mortality is of major concern, there is little knowledge about natural mortality in manatees despite a large number of deaths from unknown sources, particularly at perinatal stages. The average annual number of perinatal deaths slightly more than doubled during the period 1984 through 1988 as compared to the period 1979 through 1983. FDNR, the oceanaria, and cooperators will

make further efforts to better understand proximate causes of natural mortality, including disease, malnutrition, and cold stress. Contributions of human-related factors to perinatal mortality will also be evaluated. Blood serum from wild and recently acquired captive manatees will be screened using serological techniques to determine incidence of exposure to various viral, bacterial, and parasitic diseases of wildlife (e.g., *Toxoplasma*). Intensive histopathological and microbiological study of tissues of all fresh salvaged carcasses and sick or injured manatees will be routinely conducted, and efforts will be expanded to better classify the nutritional status of manatees. Implementation of management efforts to reduce the susceptibility of manatees will follow as these sources of mortality are recognized and better understood.

12. Minimize water vessel collisions with manatees.

As documented in Table 2, the boat/barge category accounts for more manatee deaths than any other single category except "undetermined." During the period 1979 through 1983, manatee deaths from boat/barge collisions averaged approximately 20 annually. Beginning in 1984 through 1988, boat/barge-related mortality averaged almost 37 deaths each year, and reached a record high of 43 in 1988. The following efforts will be implemented to minimize boat/barge collisions.

121. Identify/investigate areas of greatest boat/barge mortality and/or injury to improve understanding of specific problems.

Although the salvage/necropsy program has improved the knowledge of where boat/barge mortality has occurred most frequently, and has improved our understanding of specific causes of death (propeller strike vs. hull impact, etc.), FWS, FDNR, and GDNR will continue to monitor problem areas. With assistance from MIA, these agencies will also investigate the interrelationships of boat/barge use patterns, waterway dynamics, bottom configurations, and waterway infrastructures in association with manatee abundance, mortality, distribution, migration routes, spatial and temporal variations, and preferred habitats to determine remedial actions. County governments will support these studies, and will be encouraged to utilize funding from the Boating Improvement Trust Fund and other sources.

122. Develop and implement specific solutions to actual and potential boat/barge mortality and injury in particular areas.

Examples of efforts which have been developed and implemented to minimize boat/barge-related mortality in Florida include slow and idle boat speed zone regulations, with and without channel exemptions, and no-entry sanctuaries. Continued efforts and renewed commitments to find better solutions are necessary.

1221. Develop site-specific interagency manatee protection plans at the local government level.

Local governments in Florida will develop MPPs with assistance from FWS, FDCA, FDER, FDNR, COE, MIA, RPCs, the public, and other Federal, State, and local governments. Each plan will consider the cumulative impacts of boating facilities for a specific geographical area, and will include such features as identifying appropriate or inappropriate locations for marina sitings and boat ramps, establishing boat speed zones, determining dock densities, and evaluating boater use patterns and activities. These plans will assist in ensuring that future development is compatible with manatee protection, and will improve local government involvement in manatee protection efforts. New Florida growth management legislation, which requires local governments to adopt improved Local Government Comprehensive Plans and ordinances by July 1991, emphasizes the timeliness of completing MPPs. FDCA will insure compliance with provisions of the LPDA.

1222. Establish, post signs for, and enforce local/State/Federal boat traffic regulations in areas where boats and manatees are most likely to encounter each other.

If warranted, actions will be taken by FWS, FDNR, GDNR, and local governments, with assistance from MIA, to establish additional regulations for new

boat speed zones, no entry sanctuaries, maximum speed limits, slow speed - moderate wake zones, and "reserves" (see Task 234). Efforts will also be made to support and increase enforcement. Existing zones and sanctuaries will be evaluated to determine appropriateness, proper location, proper dates of regulation, and adequacy of sign posting and enforcement. FMP will develop and update annually enforcement strategies for the various manatee protection zones in Florida, taking into account the most appropriate times and locations to provide enforcement. The Banana Island and Sunset Shores sanctuaries at Crystal River/Kings Bay will be evaluated by FWS, based on completion of ongoing man/manatee interaction studies, to determine feasibility of alternative regulations such as "time-sharing" (i.e. in certain areas it may be desirable to restrict waterborne activities to specific time periods of the day).

1223. Evaluate feasibility of manatee protection devices for the class(es) of vessels identified as the causes of most propeller-related manatee mortality.

With over 650,000 registered boats of all types and size classes in Florida and another estimated 300,000 annual out-of-State transients, FDNR, FWS, and MIA will focus greater attention on designing, evaluating and testing manatee protection devices, including propeller guards, kort nozzles, jet thrusters, collision warning devices, etc. Support to develop appropriate protection devices will be solicited from national boating organizations.

1224. Evaluate feasibility of additional methods to minimize boat/barge mortality.

Additional methods to minimize boat/barge-related mortality will be evaluated by FDNR, FWS, and MIA including, but not limited to: 1) Evaluation of biological/physical bases for collisions (i.e. examination of the inner ear of salvaged manatees to determine if physical damage to hearing by

exposure to loud underwater sounds plays a role in subsequent susceptibility to collisions); 2) required boater education and/or licensing and testing; 3) the use of temporary buoys or signs; and 4) research on boat avoidance by manatees.

1225. Conduct review of permitting procedures and criteria, and utilize Section 7 consultation process to minimize potential impacts to manatees and manatee habitats.

The COE, FDER, and TIITE, with assistance from FWS and FDNR, will review permitting procedures and criteria, and will implement actions to improve interagency communications. Based on this review, appropriate changes to strengthen permitting procedures and criteria for protecting manatees and their habitats, including rule making, will be made. COE will develop, as appropriate, general permits or special area management plans consistent with local government MPPs. Through Section 7 consultations, FWS will issue jeopardy biological opinions on permit applications for construction activities which are not consistent with these plans and which jeopardize the continued existence of manatees.

13. Minimize manatee mortality caused by water control structures.

Water control structure-related deaths are second only to boat/barge collisions as identified sources of human-caused mortality. Although major efforts have been made to minimize the number of injuries and deaths associated with this cause of mortality, an average of approximately five deaths per year have been caused by water control structures since 1979.

131. Investigate specific cases of structure-related mortality and determine types of problem structures.

Water control structure-related deaths have occurred most frequently in south Florida where floodgates and navigation locks are common. FWS, FDNR, COE, and the WMDs will cooperate to identify offending structures. FDNR, as part of

the salvage/necropsy effort, will investigate specific cases, and will provide the other agencies with appropriate information as soon as a reasonable conclusion concerning a structure-related mortality is reached.

132. Inform responsible agencies of problems and gain support for solving problems.

When water control structures are identified as causing manatee deaths, the agency(ies) responsible for their construction and operation must be informed. FDNR will work with FWS, COE, and WMDs to improve communications. After the responsible agency(ies) has been given due and official notice by FDNR and/or FWS, it (they) will, within the scope of its (their) authorities and funding, support necessary research or analyses, changes in operational schedules, and/or partial or complete structural modifications if necessary to eliminate structure-related mortality.

1321. Conduct site-specific structure-related mortality studies.

FWS, with assistance from FDNR, COE, and WMDs will continue to conduct case studies to better interpret manatee behavior in relation to specific navigation locks, floodgates, culverts and other structures.

13211. For navigation structures, floodgates, culverts, and other structures, test and implement alternative operational techniques and/or structural modifications and evaluate effectiveness of modifications.

WMDs and COE will monitor problem structures at least weekly on 1 minute intervals to ensure proper operation. COE and/or WMDs will notify FDNR and FWS within one working day if a structure, that has a history of manatee association, malfunctions and poses a threat to manatee safety. This

communication will report the nature of the malfunction, anticipated duration, number and location of nearby manatees, and precautionary measures that are in effect. FDNR and FWS will monitor the area and take necessary actions to cooperate with the involved agency to ensure manatee safety. COE and WMDs will also notify FDNR and FWS well in advance of scheduled maintenance or reconstruction.

When a structure has been identified as a responsible agent in a manatee mortality, WMDs and COE will test and/or implement alternative operational techniques and/or structural modifications in agreement with FDNR and FWS as soon as it is reasonably possible. Structures operating under this test mode will be closely monitored under a variety of conditions for a period sufficient to ascertain the effectiveness of the operational or structural changes to the satisfaction of all the cooperating agencies. A detailed report of the findings of these test operations will be available to all interested parties through submission to FDNR and FWS. Upon concurrence that the change(s) is beneficial to the safety of the manatees, does not adversely affect the structural integrity of the structure(s), and does not alter the water management function of the structure, modifications will be made permanent as soon as possible. All similar structures implicated in manatee mortalities or posing an immediate threat will be similarly modified within a period of twelve months, if reasonably possible.

The WMDs and COE will provide reports by January 31, 1990, to FDNR

and FWS that outline the previous years structural and operational changes, and goals for 1990. A similar annual report will follow every year thereafter. The involved agencies will also periodically reassess water management structures as additional manatee habitat information becomes available. Structures that are mutually agreed to pose potential threats to manatees will be investigated, and a plan will be developed to improve operation to prevent future mortality.

14. Minimize other sources of human-related manatee mortality and injury.

Manatees have been drowned in shrimp, gill and hoop nets. Additional animals have died from septicemia, created by knotted crab trap and nylon fishing lines around the flipper. In addition to the unintentional "taking" of manatees by fishing activities, a few are still directly and purposefully being taken for food and sport.

141. Identify the extent to which other fishing apparatus (including crab traps, buoy lines, nets, shrimp nets, trotlines, other monofilament lines, and hooks), poaching, and vandalism are a problem and develop solutions.

These activities have resulted in an average of approximately four deaths each year since 1979. FWS, GDNR, and FDNR will determine where and to what extent these activities are problems for manatees, and will evaluate threats associated with fishing in or around power plant effluents so that necessary steps can be taken to reduce these causes of mortality and injury.

142. Monitor levels of contaminants in manatee tissues.

FDNR will continue to collect tissues of manatees recovered by the salvage program, and will monitor levels of contaminants. If high levels of contaminants are found, FDNR will immediately notify EPA and FWS. FWS will immediately notify regional contaminant specialists.

15. Rescue and rehabilitate distressed manatees.

The need to rescue and rehabilitate sick, injured, orphaned or otherwise distressed manatees is increasing, and it is important that rescue/rehabilitation efforts be improved. In Florida, Sea World of Florida and the Miami Seaquarium are the only authorized manatee rescue teams. When an injured or sick manatee is reported, the FMP field officer locates and remains with the animal, when practical, and requests that the duty officer contact Sea World of Florida. If required, Miami Seaquarium will be contacted for assistance. There is no authorized rescue team in Georgia.

FWS, FDNR, and GDNR will evaluate the need to establish additional rescue teams, and will continue to work cooperatively with the oceanaria and other qualified organizations to rescue injured or distressed animals.

151. Develop/refine rescue contingency plans for single and catastrophic events.

FDNR and FWS will develop comprehensive rescue contingency plans for catastrophic events and refine plans for single events. Contingency plans will be refined and/or developed for single and multiple rescues, i.e., boat strikes, extreme freezes, power plant failures, toxic spills, red tides, epidemics, other catastrophic events. Medical or field observational evaluation procedures will be incorporated into the contingency plans. These plans will address notification and response time, and will be detailed enough so that each agency's level of involvement and responsibilities are clearly understood ahead of time and can be implemented on a 24 hour a day basis. FDNR, FWS, and other appropriate groups will develop and update contingency plans by January 1990, and every 2 years thereafter.

152. Develop safe and effective methods of capturing distressed manatees in open water situations.

FWS and FDNR will explore and investigate the potential for developing capture techniques to supplement or replace the current methods. Techniques to facilitate capture in open water areas, where there are varying and demanding physical

problems, and techniques to induce animals to move to suitable areas for capture will be developed.

153. Develop criteria for release of rehabilitated manatees.

Consideration must be given to determining if, when, where, and how rehabilitated manatees will be released. The need for establishing reacclimatization procedures prior to release will also be evaluated. Criteria will be developed by FWS and FDNR by October 1989, with assistance from Sea World of Florida and Miami Seaquarium, and made part of the rescue plans.

154. Develop consultation arrangements with utilities, paper companies, and other industries that produce warm-water outfalls to identify plans (e.g., retirement of generating units, scheduled shutdowns, and movement of outfall locations) that could adversely affect the availability of these warm-water sources for manatees.

See Task 2236 and 236.

16. Evaluate effectiveness of current and future regulations and enforcement efforts, including the evaluation of and need for modified or expanded legislative authority.

Manatee regulations will be evaluated annually by FWS's Division of Law Enforcement, FMP, USCG, and FGC to insure that they adequately protect manatees and their habitats. Furthermore, to better identify law enforcement needs, as well as to assess current enforcement efforts, the law enforcement agencies will develop integrated law enforcement programs and strategies which will include: 1) An assessment of current law enforcement activities, including a delineation of duties, personnel involved (including cooperative programs with other agencies), and relative success and/or shortcomings of each program; and 2) recommended changes necessary to provide manatees full protection under the law will be made to the appropriate governing body, including funding for additional manpower and equipment if necessary. When a new regulation has been adopted, its effectiveness will be evaluated to determine if the desired results are being achieved. The responsible agencies will annually review both the adequacy of the regulation and the ensuing enforcement efforts. Such factors as manatee presence,

manatee mortality and injury statistics, sign posting, officer familiarity with rules, voluntary public compliance, number of citations issued, number of convictions, public sentiment, etc., when applicable, will be considered in each annual review. If enforcement efforts are judged

161. Conduct law enforcement workshops/training sessions.

Because of the numerous laws that must be enforced, it is often difficult for law enforcement personnel to be adequately informed of exactly what their responsibilities are in enforcing a particular statute, rule, or regulation. For this reason, training sessions, which will explain to officers the reasons for these rules and regulations and will allow them to provide input into the practicality and day-to-day logistical requirements of enforcing regulations, will be developed by FWS, FDNR, USCG, and FGC.

162. Standardize fines, work with court systems, and educate judiciary system.

The FWS's Division of Law Enforcement will take the lead in working with the FMP and FGC to standardize fines imposed for violating manatee regulations. Currently, fines differ considerably within the Federal court districts, and there are also considerable differences between state and Federal fines. Florida's Senior FWS Resident Agent, with support from the other agencies, will work with the various court systems to alleviate this problem, to strengthen court relations, and to educate the judiciary system about manatee conservation problems.

163. Evaluate extent of poaching and implement measures to apprehend violators.

FWS special agents, in cooperation with FMP and FGC, will develop a plan to investigate the incidence of manatee poaching, and will initiate undercover or sting operations to apprehend violators. The possibility of using monetary rewards for informants, donated by SMC and/or FGC's Wildlife Alert Trust Fund, will be pursued.

17. Conduct programs to inform and educate the public, including tourists, and encourage development of educational programs with other countries to protect manatees.

171. Expand educational and informational activities, and improve public awareness.

It is imperative that all agencies involved in this recovery plan increase their emphasis on effectively educating the public about the plight of the manatee, enhancing public awareness, and improving the availability and distribution of educational information and literature. Efforts will be directed to informing the public of how private citizens can help, such as by reporting violators and radio tags, complying with regulations, reporting sightings, providing information on types and causes of mortality, etc. Unless people who are aware of the manatee's existence can understand how man is threatening it and its environment, and are cognizant of how citizen action can aid in combating these problems, the high degree of public cooperation which is needed to save the manatee cannot be expected. Important actions to be accomplished will include, for example, updating general information brochures and leaflets, utilizing multiagency support to increase volume and improve distribution of boating and general information brochures, distributing manatee literature to boaters (MIA), revising the film "Silent Sirens", developing a manatee interpretive/education center at Crystal River NWR, and utilizing marine and car radio public information broadcasts to inform the public, particularly tourists.

172. Conduct public information surveys to evaluate effectiveness of current informational/educational programs and modify accordingly.

There is a very real need to conduct public information surveys to assess current public knowledge and opinions in Florida so as to judge the effectiveness of past programs. The surveys will be conducted by FDNR before January 1990 to provide information necessary to target areas, and determine emphases and goals for future efforts in information and education, law enforcement, and habitat protection.

A list of all the variables to be considered will be prepared for interagency review so that the surveys can be as inclusive as possible. Follow-up surveys, capable of documenting effectiveness as well as future needs, will be conducted every 3 years.

173. Expand boater and diver educational programs and target specific information to these groups.

A special effort will be made to expand educational and informational programs for boaters, divers, and other users of areas frequented by manatees. The essential information will be provided by enforcement, management, and/or research personnel, and worked into a dynamic program by education-information specialists. The program, including an informational packet and slide presentation, and/or high quality movie, will be targeted for power squadrons, Coast Guard Auxiliary groups, captain schools, boating and yacht clubs, water ski clubs, diver clubs and other groups as identified. The various professional diving instruction schools will also be approached about including manatee information in their training programs.

The manatee interpretive/education center, to be developed by FWS at Crystal River NWR, will serve to provide education and information to divers and other waterborne recreationists in the Florida Big Bend area. It will also be important in developing, testing, and coordinating interpretive efforts throughout Florida. In addition, an informational brochure will be developed by FDNR, with assistance from MIA and SMC, for marina dealers to distribute to boat owners and users of their facilities.

174. Continue posting and maintaining areas presenting greatest threat to manatees.

In some circumstances, it may be in the manatee's best interest to draw attention to those areas where they are highly vulnerable by continuing to post "Caution - Manatee Area" signs which urge boaters, fishermen and divers to use caution so as not to injure or harass manatees. Examples of such areas would be boat ramps adjacent to warm-water

power-plant refugia, and within the primary core of the refugia themselves where winter public use pressures often reach unduly high proportions. Other areas might be around marinas and docks that manatees frequent on a regular basis, or by gas pumps servicing marina traffic. Applicants who apply for permits to construct boat ramps, marinas, or other facilities in or adjacent to waterways will also be required to post such signs. FDNR will test new signing methods, such as posting maps at boat ramps, to show boaters where speed zones and important manatee habitats are located within waterways. If these methods prove successful and beneficial, local Florida governments will include such measures in their MPPs, and GDNR will evaluate similar actions for important manatee use areas in southeastern Georgia.

In addition to posting signs to draw attention to highly vulnerable areas, MMC will request NOAA to include manatee sanctuaries and boat regulatory zones on navigational charts.

18. Develop bilateral or multilateral agreements with other countries for manatee conservation and research.

The ESA and the MMPA both encourage the development of bilateral or multilateral agreements with other nations for the protection and conservation of endangered species. With respect to manatees, agreements will be developed by FWS, with assistance from MMC, to cover the following items as appropriate: (1) Review of existing scientific data and establishment of joint research projects; (2) review of adequacy of existing international and national law and related regulations, proposals for new laws or amendments; (3) protection of habitat; (4) administration and enforcement of laws and regulations; (5) plans for public education; (6) identification and recommendations of conservation roles to be played by all interested parties; and (7) proposals for funding.

2. Ensure existence of suitable manatee habitat.

Even if mortality and injury are minimized or eliminated, the continued existence and recovery of manatee populations will be dependent upon the identification and protection of suitable habitats and other areas of special biological importance. Habitat loss and degradation may prove to be the major impacts jeopardizing the continued existence of manatees in the

future. Therefore, efforts should be made to minimize habitat alteration, degradation, or destruction.

21. Identify habitat requirements and areas of special significance to manatees, emphasizing the use of state-of-the-art tracking technology.

In order to identify and protect areas of special biological importance to manatees, state-of-the-art tracking technology will be used to follow movements of individual manatees, thereby improving the understanding of habitat requirements, and to determine areas of critical importance. Characteristics of the food resources will also be determined in order to evaluate the potential importance of various areas to manatees in relation to feeding ecology.

211. Determine routes of movement and location of primary feeding, breeding, and resting areas of manatees.

It is well known that manatees aggregate in certain warm-water refugia during winter. Manatees leave these refugia for short periods during the winter to feed. However, they disperse in the spring, and for most of the annual cycle little information exists on manatee ecology and habitat use. Much can be learned about daily activity patterns, migration routes, interchange of individuals between aggregation sites, and summer habitats by radio tracking. Radio telemetric technology will be continually used, incorporating state-of-the-art developments such as satellite-monitored transmitters, to assess these parameters and to determine local areas of importance to manatees.

Radio tracking studies will emphasize broad geographic locations of concern, and new studies will be initiated in various broad areas as information needs arise. A photographic scar catalogue of individually recognizable manatees will also be maintained to supplement tracking studies with repeated sightings. Aerial surveys and carcass salvage results will be integrated with telemetry work for comprehensive evaluation of areas of importance.

212. Determine food preferences, dietary requirements, and nutritional requirements of manatees.

Knowledge of the importance of various vegetation types as

manatee foods will assist in evaluating the need to protect local habitats subject to development, degradation or alteration. Studies will be continued to determine the diet, feeding habits, food preferences, and nutritional requirements of manatees. Information on the diet of manatees and the relative importance of various dietary components is being derived from analyses of stomach contents from manatees acquired via the salvage program. These studies will be continued by FWS until a thorough documentation of food habits is completed. Follow-up studies, based on results of stomach content analyses, will investigate the relative abundance of the various food plants, their nutritional value, and the nutritional requirements and digestive physiology of manatees relative to these foods. This research will be conducted by qualified FWS, FDNR, GDNR, oceanaria, university, or private investigators as needs and resources arise.

22. Characterize and identify threats to areas of special significance to manatees.

As areas of special biological significance to manatees are identified (see Task 21 above), they will be mapped and characterized using state-of-the-art techniques and procedures, such as geographical information systems, to provide a baseline for detecting and monitoring changes in critical parameters. Additionally, existing and potential threats to those areas will be identified and evaluated to determine actions that might be needed to protect the areas or their critical elements.

221. Develop standard methods for characterizing, mapping, and monitoring important manatee habitats.

Areas of special importance to manatees will be described or characterized with respect to certain physical, chemical and biological features (e.g., physical dimension; water temperature, depth, salinity, and clarity; species composition and density of aquatic vegetation). To facilitate description, characterization, monitoring, and detection of habitat degradation or destruction, standard sampling/mapping/analytical techniques and procedures, compatible with geographical information systems, will be developed. The MMC sponsored a workshop in March 1989

to review state-of-the-art capabilities for developing and using geographical information systems, and for establishing a procedure to benefit information sharing among the agencies/groups involved. Recommendations and findings of this workshop will be published in 1989 and implemented as soon as possible.

222. Characterize and map important manatee habitats.

As areas of special importance to manatees are identified (see Task 21), they will be characterized and mapped using the techniques and procedures developed in Task 221 above.

2221. Evaluate desirability of modifying "Critical Habitat" designations, and make changes as necessary.

Land acquisition and regulatory programs may be benefitted by official designation of core habitat areas as "Critical Habitat" under the ESA. The benefits of such designation will be evaluated by FWS with input from other agencies.

223. Identify and evaluate potential threats to important manatee habitats.

As part of the process of characterizing and computer mapping important manatee habitats, existing and potential sources of pollution, siltation, disturbance, alteration, and/or destruction will be identified and evaluated.

2231. Evaluate effects of boat traffic.

As part of the MPPs and tasks previously mentioned, boat traffic patterns and activities will be determined, characterized, mapped and analyzed to determine effects on manatees and manatee habitats. Boating studies and studies evaluating the effects of boat traffic on seagrasses and other important manatee habitats will be expanded and adequately funded. The Hobe Sound Seagrass Study, for example, will continue to receive necessary funding commitments from FWS, FDNR, and NMFS.

2232. Evaluate effects of marina, dock, and boat ramp construction, shoreline restoration/stabilization, and maintenance of navigation channels.

Marina, dock, and boat ramp construction, shoreline restoration and stabilization, and navigational channel maintenance can directly affect manatee habitats by reducing aquatic vegetation in feeding areas, providing sources of contaminants, disrupting natural hydrologic regimes, and/or by increasing turbidity or siltation. Equally important, the siting of boating facilities and channel maintenance or dredging can influence densities and patterns of boating traffic. As important habitats or other areas of special significance are characterized and mapped, boating facility siting and channel maintenance or dredging in or adjacent to these areas will be analyzed and evaluated, and the information made part of MPPs.

2233. Evaluate effects of urban development, dredging and filling, and other development projects.

The impacts of urban development and dredge and fill projects on important wetland habitats will be evaluated to determine effects on the quality and quantity of manatee food resources, impacts on the natural functions of coastal wetland ecosystems, disturbance and/or alteration of plant communities (vegetative abundance, composition, and distribution), alteration of drainage patterns, and affects on water quality and clarity. Potential impacts of urban development adjacent to important manatee habitats identified by Task 222 will be studied, and the information made part of MPPs.

2234. Evaluate effects of point and non-point sources of pollution, aquatic weed control, and other activities affecting vegetation and water quality.

Manatees and their habitats can be susceptible to a variety of water contaminants, including pesticides,

herbicides, industrial byproducts (PCB's, oil, radioactive wastes, etc.), and pathogens associated with human sewage. Aquatic weed control can directly affect food resources, and can directly and/or indirectly degrade water quality. Stormwater runoff may carry heavy metals from roadsides and parking lots, and/or pesticides or nutrients from residential gardens and lawns. Agricultural land uses also provide potential sources of pollutants which can be carried in rivers to coastal areas. Wastewater input from sewer and septic systems can increase nutrient levels, over-stimulate plant growth, encourage growth of epiphytic algae on native plants, and increase suspended solids. Sources of point/non-point pollution or other activities that may impact important manatee habitats identified in Task 222 will be identified and mapped. The effects of the sources of pollutants and activities will be studied and evaluated by FWS, FDNR, GDNR, EPA, WMDs, FDER, and local governments. The overlap of manatee feeding areas with aquatic plant control programs and water quality problems will be analyzed by these agencies for all important riverine or estuarine habitats identified in Task 222. Alternatives to chemical weed control programs will be evaluated in these areas, i.e. mechanical harvesting. Also the use of alternative chemicals and periods of use will be evaluated. Aquatic ecosystems that compose or support important manatee habitats will be evaluated by FDER in terms of biological and human-related inputs and outputs to aid in determining cumulative effects of pollution. In addition, FDER will determine if aquatic ecosystem modeling will be necessary to properly determine effects. If necessary, FDER will request assistance and support from EPA, FDNR, FWS, and COE. FDER and WMDs will take the lead in studying and evaluating water quality issues.

2235. Evaluate use of water resources affecting the function of natural spring aggregation sites in Florida.

If the quantity or quality (salinity, temperature, etc.) of water flowing from natural springs in Florida were altered due to wells, mining, dredging or reduced recharge, for example, the value of these areas as warm-water refugia could change. At a reduced flow rate, less water would be warmed during winter, and manatees would be more likely to be exposed to cold stress. Reduced flow or increased salinity could also adversely affect vegetative abundance and/or composition. Therefore, the effects of water withdrawal and alteration of recharge areas on the flow of major springs identified in Task 222 will be studied and evaluated by WMDs with assistance from USGS. Information gained will be used to establish minimum flows necessary for maintaining natural warm-water refugia for manatees (as well as determining allowable water consumption standards).

2236. Evaluate industrial discharges used as warm-water refugia by manatees.

Artificial refugia are no substitute for the reliability of natural warm-water springs, and can create hazards to manatees if operations are interrupted or if manatees become trapped in intake or discharge pipes. Nevertheless, artificial warm-water refugia created by industrial effluents, as seen in Table 1, provide important winter habitat for the Florida manatee. These sites will be evaluated by FDNR and GDNR, with information provided by the various industries, to determine life expectancy, condition, plans for remodeling, phase out dates, maintenance/shutdown schedules, and other operating criteria that may adversely affect manatees. Methods will be explored to minimize impacts to manatees when plants are temporarily out of service during major aggregation periods (i.e., solar water heaters, well water discharge, etc.). The

possibility of creating additional artificial warm-water areas in or adjacent to preferred habitats and the need to phase out some marginal warm-water sources will also be evaluated.

23. Protect and monitor areas of special significance to manatees.

Using information gained from Tasks 222 and 223, the following actions will be implemented to protect and monitor manatee habitats and areas of special significance.

231. Expand and increase number of state and Federal refuges, reserves, preserves, parks, and management areas in or adjacent to essential manatee habitat.

Incorporation of a full complement of essential summer, winter, and migratory habitat into existing state and Federal systems of protected areas can provide valuable protection for coastal ecosystems while providing for human activities and uses compatible with manatee protection. FWS, NPS, FDNR, GDNR, FGC, and MMC will cooperatively develop and implement a comprehensive land acquisition plan to protect important manatee and other aquatic habitats in Georgia and Florida. The plan will establish priorities; describe significance of the area to manatees, other endangered species, and other wildlife resources; and give reasons for acquisition versus protection by other measures. Local Florida governments will determine the feasibility and need for acquiring fee title or development rights to wetlands in their Comprehensive Development Plans. FDNR, as a member of the State's Land Acquisition Selection Committee, will review lands listed under the CARL program; where justifiable, will recommend that manatee habitats receive priority consideration; and will list additional projects with this program for funding. FDER will likewise review the Save Our Rivers program, and will make appropriate acquisition recommendations to the State's five water management districts. Florida's TIITF will approve acquisition of important habitats identified by State acquisition programs, and will request recommendations from local and state agencies. GDNR will review its acquisition programs and will support recommended acquisition of manatee habitats. FWS will complete Preliminary Project Proposals and Land

Protection Plans on areas already identified in the Marine Mammal Commission's reports on acquisition needs, will support state and local acquisition proposals, and as funds become available, expand national wildlife refuges to protect manatee habitats. NPS will likewise develop and pursue acquisition proposals to expand national parks and seashores where needs to protect manatee habitats have been identified.

Specific acquisition efforts will include, but will not be limited to, completion of Florida's CARL projects on the Crystal and St. Martin's rivers, and FWS's expansion of Chassahowitzka, Lower Suwannee, and Crystal River NWRs. FWS, and other agencies as appropriate, will also support and pursue recommendations made by MMC in its preliminary east coast acquisition report. Private groups, such as TNC, Sierra Clubs, and Audubon Societies, will be encouraged to support acquisition efforts.

232. Provide for protection of manatees in management plans for Federal and state systems of protected areas.

Currently there are many existing Federal and state systems of protected areas with immediately adjacent waters and/or waterways which pass through these areas that provide essential manatee habitats. However, because of conflicting authorities for managing coastal and/or navigable waters, these adjacent waters/waterways are frequently not included in area management plans. Therefore, many areas may not be contributing to manatee protection efforts to the extent that is possible or necessary. Additionally, some agencies, even though they do have the authority to protect manatees, may not have addressed manatees in their management plan(s) and therefore are not implementing protective measures. The MMC has completed a preliminary report on habitat protection needs for eastern Georgia and Florida. This report identified existing Federal and state refuges, parks, preserves, etc. containing or adjacent to manatee habitat. It also provided recommendations for strengthening management actions and expanding the boundaries of some of those areas that are of particular importance to manatees. FWS, NPS, FDNR, GDNr, FGC, and other agencies will require the development and implementation of research and management plans and programs to address manatee

protection needs at established refuges, preserves, reserves, parks and wildlife management areas, which contain essential manatee habitat. The Land Management Advisory Committee, Florida Division of State Lands, when reviewing State agency management plans, will ensure that manatee protection needs are addressed where appropriate.

233. Designate additional areas as "Critical Habitat".

If additional areas (such as the Homosassa River; the estuaries and lower portions of the lower Suwannee, Chassahowitzka and Withlacoochee rivers; certain core use areas on Florida's and Georgia's east coasts) and/or additional important manatee habitats or travel corridors are determined by Task 2221 to need "Critical Habitat" designation, FWS will amend Title 50, Code of Federal Regulations, Part 17.95(a).

234. Establish and expand a network of manatee "reserves" and protected connecting travel corridors.

As information determines the need(s), FWS, GDNR, and FDNR, with support from MIA, FDCA, FDER, COE, and local governments, will expand and establish a network of "reserves" with connecting corridors to protect manatees and their habitats. Depending on the type and degree of threat identified in Tasks 1222, 223, and 31, "reserves" will be established with varying objectives and regulations. For example, FWS, as provided by 50 CFR 17.103, may establish two different types of "reserves" known officially as "manatee protection areas." Such areas are further defined as either "manatee refuges" or "manatee sanctuaries." A manatee refuge is "an area in which the Director of the FWS has determined that *certain* (emphasis added) waterborne activities would result in the taking of one or more manatees, or that certain waterborne activities must be restricted to prevent the taking of one or more manatees, including but not limited to taking by harassment." A manatee sanctuary is more restrictive than a "refuge," and is "an area in which the Director has determined that *any* (emphasis added) waterborne activity would result in the taking of one or more manatees, including but not limited to taking by harassment."

Therefore, depending on the desired objective, resulting regulations may allow human activities on some "reserves" while other areas may be designated as inviolate sanctuaries. Local Florida governments will address the need to establish such "reserves" and protective travel corridors in their Comprehensive Development Plans and MPPs.

235. Protect and monitor quality and quantity of water flowing from natural springs in Florida.

The consumptive use of water is regulated by the various WMDs. The importance of maintaining the flow of springs will be included by WMDs and local governments in the water use plans and Comprehensive Development Plans, respectively. WMDs will adopt policies to ensure that use of warm-water springs by manatees have priority over consumptive water use. FDER will monitor WMD permits to ensure that these policies are enforced. WMDs will monitor cumulative effects of water withdrawals and potential changes in recharge rates in evaluating effects of proposed water consumption. FDER and the districts will also monitor water in and adjacent to major springs to ensure that wastewater discharge and land use in recharge areas does not reduce either quality or quantity of spring flows below State water quality standards. Counties and local governments will adopt regulations to further protect these waters.

236. Protect the integrity of artificial industrial effluents as important winter habitat.

Utilities and industries producing warm-water effluents used by manatees, such as FPL and Gilman Paper Company, (see Table 1), will cooperate with FWS, FDNR, and GDNR to develop operational plans for facility retirements or major overhauls that would significantly disrupt warm-water discharges during the winter aggregation period. Notice of planned retirement of a facility will be given as soon as information is available or if possible at least 5 years prior to the date of such retirement. FWS, FDNR, and GDNR will cooperatively work with utilities and industries to mitigate possible detrimental effects of operational changes, and will recommend alternative methods identified in Task 2236. Unplanned failures, shutdowns, or other major reductions in

effluents will be reported to FWS, FDNR and/or GDNR as soon as possible if they occur during the winter aggregation period (October - March).

237. Protect and maintain integrity of coastal ecosystems that support manatee habitats.

Coastal management planning will be an integral part of protecting the marshes, estuaries, and river systems that support manatee habitats. In Florida, the State and local governments will address coastal zone management and conservation in their Comprehensive Development and MPPs. Local governments will rezone wetlands to conserve and protect marshes and wetlands, and deny applications for DRI's within the coastal zone if they are not consistent with these plans. FDCA will review local government plans, ensure that they address these policies, and recommend denial of DRI's that are inconsistent with these plans and policies. FDER and WMDs will review permitting processes and regulations, will draft legislation to consider impacts from non-point sources of pollution, will develop and require design permitting criteria and/or performance standards for construction in or adjacent to wetlands, and consider indirect and cumulative impacts of projects on coastal wetlands. FDNR's Division of State Lands and COE will implement established procedures for evaluating individual permit applications in terms of cumulative impacts, and will deny applications where these criteria are exceeded as defined in 33 CFR 320 - 330 and 40 CFR 230.

GDNR will, where necessary, implement similar actions to protect and maintain manatee habitats.

To improve the coastal management planning process, the involved agencies will attempt to work more closely together by promoting the exchange of information and research findings, and by identifying and mapping important manatee habitats. Information sharing will be benefitted by completion of FDNR's GIS.

238. Maintain, protect, and monitor water quality and vegetation.

In areas of special significance to manatees, needs exist to

establish and enforce water quality standards, establish and enforce effluent standards, control construction of sewage systems, monitor water quality and effluent discharges, reduce exposure of manatees to aquatic herbicides, and maintain, protect, and improve amounts of vegetation available to manatees as food.

To meet these needs, local governments in Florida will adopt appropriate ordinances, based upon studies completed in Task 2234, that provide for on-land retention of runoff adjacent to manatee habitat. They will also develop regional solutions to sewage treatment and disposal, and with assistance from FDER, will establish monitoring schedules for sewage treatment plants. Local aquatic weed control divisions will support and implement aquatic weed control programs (to be developed cooperatively with COE, FWS, and FDNR) by using alternative treatment schedules and/or mechanical harvesting during periods when manatees are most susceptible to herbicides. FDER will deny renewal of sewage treatment plant certification if studies indicate degradation of water quality. FDER will also strengthen runoff regulations and establish water quality based effluent standards. FDNR will continue to analyze contaminants in tissues sampled from manatee carcasses recovered through the salvage program. EPA will review certification of herbicides and pesticides used in manatee habitats and establish guidelines to strengthen label precautions. COE, FWS, FDNR, and local aquatic weed control divisions will develop appropriate aquatic weed control plans (similar to plans at Crystal River), and aquatic weed control agencies will comply with recommendations to protect vegetation in designated feeding areas. COE will annually summarize chemical treatments to update these plans.

GDNR will urge local governments in Georgia to take similar efforts to protect areas of special significance to manatees in southeastern Georgia.

239. Properly locate boating facilities and navigational channels.

In Florida, local governments, through their MPPs, will take the lead in planning boating facilities to ensure protection of manatees. FDCA will ensure that these plans address proper

siting of boating facilities. Local governments, FDER, and TIITF will deny permit applications and submerged land leases that are inconsistent with these plans. COE will subsequently deny applications without prejudice. FDNR and FWS will review COE permits and projects to evaluate consistency with these plans.

FDNR, GDNR, USCG, Navigation Districts, and local governments will develop, install, and properly maintain signs and channel markers to regulate boating activities in manatee habitats.

As continuing research indicates the need, GDNR will also develop procedures and permitting criteria for properly siting boating facilities in southeastern Georgia.

240. Monitor permit requests under Section 7 of the ESA for developments in manatee habitats.

See Task 1225.

24. Determine desirability and feasibility of managing and/or developing habitats for enhancing use by manatees.

It may be desirable to manage habitat(s) to enhance its use by manatees. For example, dredging may be necessary to provide access to otherwise inaccessible feeding areas. (The MMC's preliminary report on habitat protection needs on the east coast of Florida and Georgia gives some specific recommendations.) Therefore, the desirability and feasibility of managing habitat for manatee utilization in unoccupied areas will be evaluated by FDNR, GDNR, and FWS. Likewise, the development of new habitats will be evaluated by these agencies.

3. Minimize harassment of manatees.

Manatee harassment takes many forms, varies in intensity, and affects individual manatees in different ways, most of which are not well understood.

31. Evaluate extent and minimize effects of harassment on manatees.

As man's activities continue to intensify and expand into additional

manatee habitat, it is increasingly important to have sound methods for defining and measuring the effects of the resultant harassment.

311. Minimize manatee harassment/disturbance by boat and barge traffic.

Very little is known about the effects of boat/barge harassment and disturbance on manatees. In addition to those measures described in Task 31, the subject should be further studied in conjunction with the aforementioned tasks under Section 1. Examples of harassment that are currently being addressed to some extent are the problems of boats and divers disturbing manatees in Crystal River, Florida and at other refugia. These need to be studied further to determine if there is a threshold at which manatees will leave if the disturbance(s) becomes too great.

312. Minimize harassment by divers and swimmers.

Although harassment as a result of swimming and diving activities is mostly confined to a few particular areas in Florida, such as Crystal River, Blue Spring, Fanning Spring, Riviera Power Plant, and a few other clear water areas, the harassment problem is often so intense that manatees are driven out of their preferred habitat. The direct and indirect effects of this type of harassment will be determined.

Many harassment problems associated with swimming and diving activities fall into several categories depending on the area and the manatee's previous exposure to divers: 1) Mere presence of diver(s); 2) non-contact advance by diver (chasing); 3) grabbing, riding or other physical contact; and 4) equipment noise (SCUBA). Since much of the information on diver-related harassment has to date been obtained by way of secondary observations and interpretations, specific studies will be designed to determine the nature and frequency of manatee/diver interaction under various circumstances. The work that is presently being done at Crystal River National Wildlife Refuge should be expanded to benefit necessary management practices that will minimize harassment in the Crystal River area and elsewhere.

313. Minimize harassment by fishing-related activities.

Fishing activities in the outfalls of utilities, paper companies, and other industries that produce warm-water discharges will be evaluated by FDNR, GDNR, and FWS to determine extent of harassment. Where necessary, such activities will be eliminated. Also see Task 141.

314. Evaluate effectiveness of and expand educational programs, regulations, and enforcement efforts for reducing all forms of harassment, and modify accordingly.

Educational programs, enforcement efforts, and regulations to minimize or eliminate harassment will be monitored/evaluated to ensure their effectiveness (See Task 17). These efforts will be expanded as needs are identified.

4. Determine and monitor the status of manatee populations.

Current information regarding the status of manatee populations in the southeastern United States is incomplete. There is a critical need for improved information on population sizes and dynamics to evaluate threats to populations and successes or failures of management actions. Responsible agencies will immediately begin to explore and implement new and improved methods to satisfactorily estimate and/or index population size.

41. Continue to utilize aerial survey and radio tracking techniques to monitor general patterns of distribution and relative abundance in geographic regions of special concern.

Aerial surveys provide valuable information, and will be continued and expanded by various organizations and agencies where a long-term data base has been established or where specific needs can be met using these techniques. For example, GDNR will initiate summer and winter surveys.

411. Designate a working group from among those currently conducting or supervising aerial surveys using existing methodology.

Until better survey techniques are available, a working group of biologists familiar with current manatee aerial survey methodology will be established to improve communications

about and standardization of these methods. This group will be supported by statisticians and population ecologists, who have experience in aerial survey techniques and population modeling, and by a representative from MIA. Emphasis will be placed on standardization of winter counts at selected sites, summer counts in selected areas, determination of the percentage of calves, stratification of individuals, designation of survey units, and use of appropriately scaled maps.

412. Convene an annual meeting of the working group to discuss problems, review existing data, and evaluate current population status.

Available population information will be evaluated annually by the working group to assess population status. Information reviewed could include: Winter counts, summer counts, and percentage of calves determined by aerial surveys; life history data collected by snorkeling at selected sites (Blue Spring, Crystal River, and power plants); and mortality data obtained through salvage.

42. Refine methods to monitor status of manatee populations.

Current methods for counting manatees lack a statistical basis for estimating or indexing population size; thus evidence is inconclusive on whether the population is increasing or decreasing. Current aerial survey techniques involve variable effort (inverse sampling) over the survey area. For example, more time is spent circling over portions of the survey area in which manatees are expected to occur or where difficult survey conditions (especially turbid water) require greater effort for the observer to feel confident that the number of manatees counted is the number present. Statistically valid estimation or indexing procedures require standardized, repeatable sampling methods. Until environmental factors that influence the visibility of manatees during surveys can be controlled or corrected for, biologists do not believe conventional survey methodology results will be reliable and comparable.

421. Continue development and evaluation of aerial survey methods for estimating or indexing manatee abundance in survey/management areas, and ultimately Statewide.

Standard survey techniques will be developed by FDNR and

FWS to control or correct for variables such as temperature, visibility, and observer bias that affect accuracy and comparability of surveys. Two major objectives have been identified. The first is to develop an index to predict trends in manatee population size over time, and the second is to develop survey/census methods that produce population estimates with acceptable confidence intervals. Beginning in 1989, methods will be developed and tested at specific survey areas. Some methods will probably be site-specific. Within 1 year after developing successful methodology, criteria will be established for combining results from surveys at different sites to produce annual Statewide population estimates. FDNR will hire additional full time personnel to supervise and coordinate the development and evaluation of aerial survey methodology. This methodology will subsequently be used by GDNR for surveying manatees in southeastern Georgia, and contribute to a southeastern United States population estimate.

422. Further evaluate the feasibility of utilizing mark/recapture methodology for population estimates.

Preliminary evaluation of utilizing mark/recapture techniques to estimate manatee population size indicates that the requirements for an active tagging program are impractical. This is due to the large number of manatees that are required, and the length of time needed to recover data for any useful estimate (Packard and Nichols, 1983). However, the potential for an experimental design that integrates use of pre-existing scar patterns with mark/recapture models requires further study. Scar cataloging of individual manatees has been of proven value, and a large data base for scarred individuals currently exists for some regions. FWS and FDNR will cooperatively explore the possibility of using such methods to estimate populations, and will periodically review the use of other mark/recapture techniques for population studies.

43. Determine aspects of life history and ecology.

The importance of long-term, comparative studies of basic life history traits is well established. Because manatees are endangered and protected, there are no alternatives to long-term research for

gathering many types of life history information. The majority of the work must be conducted under field conditions, supplemented with data collected from captive animals if possible.

431. Continue assessment of the vital parameters (size, age/sex structure, age-specific survival and reproductive rates) of manatee populations in: (a) Crystal River, (b) Blue Spring, and (c) other areas as identified.

One of the principal objectives of life history field research is to gather basic information necessary to understand manatee population dynamics. FWS will continue long-term comparative studies of individuals in clear water conditions. Information on age and sex structure, age at first reproduction, lifetime reproductive output, and longevity will be required. Information on breeding season, gestation period, and calving intervals is important. Variable reproductive traits are also useful indicators of population quality and status. FWS will continue long-term monitoring of life history traits to determine variability in population dynamics within and between areas.

432. Utilize population modeling to develop insights into the relative importance of various life history parameters in the manatee's population dynamics.

As outlined in Task 431, life history data are being collected at several sites in Florida, providing a range of values for life history parameters which can be used to construct alternative population models. The process of model construction will allow manatee biologists to synthesize data and compare alternative life history concepts of importance to manatee management. FDNR and FWS will further explore population modeling, and will develop computer programs for this purpose.

433. Expand assessment of manatee population genetics (i.e. variability, minimum population size, local genetic structures of populations, etc.)

Genetic research will be expanded by FWS and FDNR (and supported by MMC) to enable determination and monitoring of genetic diversity, heterozygosity, regional variation, effective

population size, kinship probabilities, and individual identification. New molecular tools will be applied as appropriate, including the analysis of hypervariable minisatellite DNA ("DNA fingerprinting"). Tissue samples will be collected and preserved by FDNR from all suitable salvaged carcasses and captive manatees for future genetic research. MMC is currently funding a pilot study to assess the feasibility of using DNA fingerprinting.

434. Continue development and evaluation of age determination techniques.

Age determination techniques have not been developed for manatees. Microscopic layering of bone tissue is evident, but it is not clear if the growth layers or groups of growth layers are age related. Tetracycline injection provides a time mark by causing fluorescence in bone layers. By examining the number of layers deposited subsequent to injection, the correspondence of layers to various time periods can be established. Knowledge of true age can provide a controlled check. To date, over 50 manatees in Florida have been tetracycline-marked in anticipation of eventual recovery of carcasses for bone layer examination. Currently a small number of suitable skeletons have been recovered, and the skeleton of one known age wild animal has recently become available. An initial study to determine if bone layering provides a suitable technique for age determination is being supported by MMC. If the technique proves successful, FWS and FDNR will develop experimental designs to employ it in a number of ways to better understand manatee population biology. These will include establishing the degree of correlation between true age and measures of relative age (such as size, eye lens weight, epiphyseal closure and suture ossification, collagen breaking strength, and protein racemization rate); investigating age related aspects of reproduction; and estimating population age structure and survival schedules.

435. Continue long-term studies of social structure and behavior, emphasizing the use of radio telemetry.

Information on social structure and dynamics, dispersal, immigration and emigration will be obtained by FWS and

FDNR using observational methods and radiotelemetry techniques over long periods of time. Information on behavior patterns will be related to life history phenomena, including population genetics. Visual, auditory, and chemical senses will be examined, including their role in intraspecific communication. Research is presently being conducted along these lines, and will be expanded by FWS and FDNR.

436. Conduct bio-telemetry or other studies with captive and/or free-ranging manatees to determine physical, physiological and metabolic response to changes in water temperature, harassment, salinity, and other variables.

The assessment of aspects of metabolic physiology will continue to prove invaluable in immediate and long-term recovery efforts, and will be evaluated by FWS, FDNR, and oceanaria.

44. Maintain and expand captive research programs with associated support facilities.

Manatees in captivity will be used to aid in the recovery of the species. Since there are presently about 28 manatees in captivity, research programs by FWS, FDNR, and oceanaria will be expanded to study rehabilitation, tagging, and other management techniques. Research will also be carried out on behavior, ecology, nutrition, and physiology using captive manatees in conjunction with free-ranging animals.

Facilities need to be specifically designed to carry out research. Therefore, design and operating specifications will be developed for cooperating oceanaria to ensure compliance with the Animal Welfare Act and USDA regulations. Additional qualified oceanaria will be granted permits by FWS and FDNR to assist with these efforts as the need arises.

FWS and FDNR will also develop reporting criteria for manatees held in captivity. Oceanaria will be required to keep detailed records on individuals maintained in their facilities, and report this information at least annually to FDNR and FWS. FWS and FDNR will maintain this information in a computer based program to aid researchers in tracking individual manatee life histories and pedigrees.

Captive research will be conducted on salvaged animals and those born in captivity. There will be no effort to remove healthy animals from the wild to conduct captive research.

5. Coordinate implementation of recovery activities, monitor and evaluate progress, and update/revise the Recovery Plan.

Coordination and cooperation are essential for the successful implementation of this recovery plan. The following actions will be taken to ensure that the identified recovery tasks and efforts by the various responsible Federal, state, and private organizations are properly coordinated, prioritized, carried out, and periodically evaluated.

51. Maintain State and Federal manatee coordinator staff positions.

FWS and FDNR will maintain staff positions with responsibilities for planning, coordinating, and monitoring all activities relating to the recovery of the Florida manatee. FWS's manatee coordinator will serve as the central focus for all Federally-related manatee activities. As such, the coordinator will serve as the chairperson for the Florida Manatee Recovery Team, and will foster coordination among states and private organizations in the southeastern United States actively engaged in manatee restoration and management. State staff will coordinate with the FWS's manatee coordinator, serve on the recovery team, provide the central focus for all related state recovery responsibilities, and provide oversight to other state agencies and private organizations.

GDNR will evaluate the need to designate a staff position to coordinate these responsibilities.

52. Maintain the Florida Manatee Recovery Team and FDNR's Manatee Technical Advisory Council.

The Florida Manatee Recovery Team will be maintained. Team membership will be approved by the Regional Director for FWS's Southeast Region. Each primary agency or group engaged in recovery activities will maintain a representative on the team. The Recovery Team will meet semiannually to coordinate and monitor implementation of recovery tasks, develop annual work plans, and update the recovery plan. (See Tasks 53 and 54.)

The Manatee Technical Advisory Council will be maintained to provide advice, oversight, and assistance to FDNR in coordinating the accomplishment of manatee recovery activities.

53. Update the Florida Manatee Recovery Plan.

The Recovery Team will be responsible for updating and revising the Recovery Plan 5 years from the date the final (or last revised) plan is approved.

54. Develop Annual Work Plans.

The Recovery Team will meet during the second quarter of each year to identify and place in priority order the most important recovery activities which the participating agencies, groups, and organizations should attempt to fund and accomplish during the following year. These specific projects will be recommended to the heads of the responsible Federal, state, or private organizations who will meet in August each year to decide what their organizations will or will not attempt to accomplish. Following agreements by the heads of the participating organizations, the Recovery Team will develop an Annual Work Plan and implementation schedule.

541. Publish an annual report on the previous year's accomplishments, including a detailed account of agency expenditures for manatee protection.

The Recovery Team will be responsible for completing and disseminating this annual report by March 1.

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IMPLEMENTATION SCHEDULE



III. IMPLEMENTATION SCHEDULE

Priorities in Column 4 of the following Implementation Schedule are assigned as follows:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to provide for full recovery of the species.

NOTE: Each task in the Implementation Schedule is given one of the above described priority numbers. While these numbers reflect the importance of the activity, they do not relate to the order in which tasks will be accomplished. For example, while a task may be identified as a priority 2, or one which must be taken to prevent a significant decline in the manatee population, it may be one of the first actions that the agencies will undertake. The specific tasks will be organized in priority order of accomplishment in Annual Work Plans.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or Research - R

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

IMPLEMENTATION SCHEDULE COST INFORMATION

- 1. Cost estimates are for planning purposes and will be refined through the agency budget process as new research findings or management information dictates.**
- 2. All agencies will strive to carry out all tasks identified in the implementation schedule. However, this will be contingent upon appropriations, personnel availability and other constraints. Each agency will develop an individual participation schedule which will outline the specific tasks the agency will accomplish and the time frame for accomplishment.**
- 3. Routine agency activities that do not lend themselves to separating out costs for manatee recovery such as ongoing law enforcement, coordination, or other programs, may not be included in the schedule.**
- 4. Land acquisition costs are not included in this schedule because these efforts serve multiple resource objectives. The one exception is the Crystal River National Wildlife Refuge where lands are being acquired for the primary purpose of protecting habitats for the Florida manatee.**
- 5. Costs may rise or be modified for future years as current research programs provide management recommendations that are currently not planned. Additionally, the initiation of some tasks are contingent on the completion/results of others. Therefore, target dates for some actions may require adjustments over time.**

FLORIDA MANATEE RECOVERY PLAN FUNDING SUMMARY (\$000'S)*

AGENCY	CURRENT FUNDS	FUNDS NEEDED**			
		FY2	FY3	FY4	FY5
COE	85	80	70	70	60
FDNR	790	1,420	1,523	1,526	1,992
FWS	1,070***	3,683	3,169	1,619	760
FPL	61	63	66	69	72
OCEANARIA	114	112	112	112	112
MIA	10	25	-	-	-
SMC	122	136	143	151	157
GDNR	1	18	18	18	18
MMC	40	-	-	-	-
TOTAL	2,293	5,537	5,101	3,565	3,171

* Note: Does not include cost estimates for other agencies such as Local Governments, Regional Planning Councils, Water Management Districts, U.S. Coast Guard, etc. Also does not include routine agency activities that are not subject to accurate cost estimates such as law enforcement.

** Note: The findings of research studies and the response of the Florida manatee to the recovery program will result in changes in these cost estimates.

*** Note: FWS costs for Current Year and FY2- FY4 include acquisition costs. See Task 231 in the Implementation Schedule for further explanation.

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority (See P.72)	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes (See P.87)
							FY 2	FY 3	FY 4	FY 5	
R-1	Maintain and improve salvage/necropsy program	111	1	Continuing	FDNR	90	150	135	140	145	Fy-2 (new pole barn necropsy facility, vehicle, 2 FTE) Does not include costs for FMP or GFC verification and securing carcasses
					GDNR FGC						No estimate No estimate
R-1	Maintain and improve reporting system for salvage/necropsy program	112	2	Continuing	FDNR GDNR FGC						No estimate No estimate No estimate
R-1, M-7	Determine causes of natural mortality and implement action to reduce deaths, particularly at perinatal stages.	113	1	Continuing	FDNR FWS OCEANARIA	In 111 2 2	25 5 2	25 5 2	25 5 2	25 5 2	(EPA participation encouraged)
M-3	Identify/investigate areas of greatest boat/barge mortality	121	1	Continuing	FDNR FWS NIA GDNR	10*	25	?	?	?	See 1221 See 1221 Local NIA participation No estimate
R-4, M-7	Develop and implement solutions to boat/barge death and injury	122		Continuing	FWS FDNR NIA						See 1221 See 1221 See 121
I-4, M-3, M-7	Develop manatee protection plans	1221	1	Continuing	L.GOV'T/RPCs FWS FDCA FDER FDNR	2 125	10 150	10 160	10 170	10 130	No estimate Routine Routine Includes Fed. Sec. 6 but not \$ for boating studies under 2231
					COE NIA	10	10	10	10	10	Local NIA participation

*Palm Beach & Treasure Coast MIA - Funds can also be applied to Tasks 122, 1224, 174, 2231, 2232, 239 & 311. No estimate for FY3 - FY5.

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
O-2,3	Establish and enforce additional boat/barge traffic regulations	1222	1	Continuing	FWS FDNR & FMP USCG FGC LOCAL GOV'TS RPCs MIA GDNR	2	5	10	10	10	See 1221 No estimate No estimate No estimate No estimate Local MIA participation No estimate
R-4	Design, evaluate, and test manatee protection devices for boats	1223	2	Continuing	FDNR USCG FWS MIA	5	25	25	0	0	No estimate Routine Local MIA participation (Participation by private industry)
M-7, O-3	Evaluate/implement additional methods to minimize boat/barge mortality (i.e. temporary signing, boater licensing, boat avoidance research)	1224	2	Continuing	FWS FDNR MIA SMC LOCAL GOV'TS RPCs	11	12	12	13	13	See 1221 See 1221 See 121 No estimate Routine
M-7, O-3	Review permitting procedures and criteria	1225	2	Continuing	COE FDER TIIITF FWS FDNR FDCA MIA LOCAL GOV'TS RPCs	70	70	60	60	50	Routine Routine Routine Routine Routine Local MIA participation No estimate Routine (SCS participation)
I-4, M-7	Investigate cases of structure-related mortality and determine types of problem structures	131	2	Continuing	FWS FDNR COE WMDs						Routine Routine Routine No estimate

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/Notes
							FY 2	FY 3	FY 4	FY 5	
M-7, O-1	Inform responsible agencies of deaths related to water control structures and gain support	132	2	Continuing	FDNR FWS COE WMDs						Routine Routine Routine No estimate
R-4	Conduct site-specific structure-related mortality studies	1321	2	Continuing	FDNR COE WMDs FWS	5	50	75	0	0	No estimate No estimate Routine
M-7	Test/implement alternative operational methods and/or structural modifications	13211	2	Ongoing Completed by 1/90	COE WMDs						No estimate, but likely \$50 - \$200K No estimate, but likely \$50 - \$200 K
I-14, I-4	Identify extent of other sources of mortality and injury and develop solutions (i.e. crab traps, nets, lines, hooks, vandalism, poaching)	141	2	Continuing	FWS FDNR FGC GDNR						Routine Routine Routine No estimate
I-12	Monitor contaminants	142	2	Continuing	FDNR EPA						Routine No estimate
M-7	Rescue/rehabilitate distressed manatees	15	2	Continuing	FWS FDNR OCEANARIA	8 50 110	8 25 110	8 30 110	8 35 110	8 40 110	Contracts w/Oceanaria Homosassa Facility
M-7, O-4	Develop/refine rescue contingency plans (including catastrophic events)	151	1	Completed by 1/90	FWS FDNR OCEANARIA						Routine Routine Routine (Update plan every two years)
I-4	Develop methods of capturing distressed manatees	152	2	Continuing	FWS FDNR OCEANARIA	1 5	2 10	0 -	0 -	0 -	No estimate for FY-3/5 See 15

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
M-7	Develop criteria for release of rehabed manatees	153	2	By 10/89	FWS FDNR OCEANARIA						Routine Routine Routine
M-3, 0-4	Develop reporting criteria for power-plant retirements, shutdowns, and outages.	154 (also see Task 236)	2	1 year	UTILITIES FWS FDNR						Routine Routine Routine
0-2	Evaluate current and future enforcement regulations and develop enforcement programs	16	1	Continuing	FWS FDNR USCG FGC MIA LOCAL GOV'TS						Routine Routine Routine Routine Local MIA participation
0-1,2	Conduct enforcement workshops/training sessions.	161	2	Continuing	FWS FDNR USCG FGC	2 5	5 5	5 5	5 6	5 7	In-service training No estimate No estimate
0-2	Standardize fines, work with courts, and educate judiciary system	162	3	Continuing	FWS FDNR FGC LOCAL GOV'TS						Routine Routine Routine Routine
0-2	Evaluate extent of poaching and implement measures to apprehend violators	163	2	Continuing	FWS FDNR FGC SNC	1	1	1	1	1	Routine Routine Routine (Reward fund)

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
0-1	Expand education/ information and improve public awareness	171	1	Continuing	FWS	20	30	1,040	45	50	Mainly CRNWR Int. Center
					FDNR	15	30	35	40	45	
					FPL	12	13	14	14	15	
					FGC						No estimate
					USCG						No estimate
					SMC	75	77	79	82	85	
					MMC	3					
					MIA						Local MIA participation
					SIERRA						No estimate
					OCEANARIA						No estimate
0-1	Conduct public information survey to evaluate effectiveness of current information/ education programs and modify as needed	172	3	By 1/90	COE	5					No estimate for FY-2/5
					LOCAL GOV'TS						No estimate
					GDNR	1	2	2	2	2	
					FDNR	5	40	0	0	50	
0-1	Expand boater/diver education programs	173	1	Continuing	FWS						See 171
					FDNR	15	30	35	40	45	
					SMC	3	3	4	4	5	
					MIA						Local MIA participation
					FPL	19	19	20	21	21	
					POWER SQUAD.						No estimate
					COAST GU. AUX						No estimate
M-3,7	Continue posting and maintaining areas presenting greatest threats to manatees	174	1	Continuing	FDNR	35	150	200	250	300	
					FWS	5	10	10	10	10	
					LOCAL GOV'TS						No estimate
					COE						Routine
					USCG						No estimate
					MIA						See 121
					NOAA						No estimate
					GDNR						No estimate
0-4, R-1	Develop agreements with countries	18	2	Continuing	FWS/MMC						Routine
					FDNR						Routine
					SMC	2	3	3	4	4	

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
R-3, R-8	Determine routes of movement and primary areas of special significance to manatees	211	1	Continuing	FWS	205	340	340	340	340	
					FDNR	75	220	230	240	250	
					FPL	10	11	12	13	14	
					NFWF	15	15	15	15	15	
R-3	Determine food preferences and dietary requirements	212	3	4 years	FWS	8	8	9	9	0	
R-2,3	Develop standard methods for characterizing, mapping, and monitoring habitats	221	2	Continuing	FWS	5	5	5	5	5	Routine
					FDNR MMC	8					
R-3, M-3	Characterize and map important habitats	222	2	Continuing	FWS FDNR	5	5	5	5	5	See 1221
O-4	Evaluate need to modify "Critical Habitat" designations	2221	3	1 year	FWS FDNR MMC		5				Routine Routine
R-2	Evaluate effects of boat traffic on important habitats	2231	1	Continuing	FWS	70	70	70	150	150	Hobe Sound Study thru FY-3. Other areas in FYs 4/5. Assumes local gov't help Hobe Sound Study Salary by FWS See 121 No estimate No estimate
					FDNR	100	125	150	175	200	
					SMC	2	2	3	0	0	
					NMFS MIA LOCAL GOV'TS RPCs MMC	13					
R-2	Evaluate effects of marina, dock, and boat ramp construction and maintenance of navigation channels on important habitat	2232	1	Continuing	FWS						Routine Routine Routine Routine No estimate See 121mate
					FDNR	50	80	85	90	95	
					FDER						
					FDCA COE L. GOV'T/RPCs MIA						

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
R-2	Evaluate effects of urban development, dredging and filling and other projects on important habitat	2233	1	Continuing	FWS FDNR FDER FDCA COE LOCAL GOV'TS RPCs						Routine See 2232 Routine Routine Routine Routine No estimate No estimate
R-2	Evaluate effects of point/non-point pollution, aquatic weed control and other activities affecting vegetation and water quality	2234	1	Continuing	FWS FDNR FDER WMDs EPA COE LOCAL GOV'TS RPCs						Routine Routine Routine No estimate No estimate Routine No estimate No estimate
R-2	Evaluate use of water resources affecting natural spring aggregation sites	2235	1	Continuing	WMDs USGS						No estimate No estimate
R-2	Evaluate industrial discharges used as warm-water refugia	2236	2	Continuing	FDNR FWS UTILITIES INDUSTRIES						Routine Routine Routine Routine
A-1,2,3,4,6	Expand and increase number of State and Federal refuges, reserves, preserves, parks, and management areas	231	1	Continuing	FWS* OTHER AGENCIES	650	3,000	1,500	900	0	*CRNWR Inter./Ed. Center site (\$2,150,000 in Current and FY-2) 3,000 acre addition to CRNWR for \$3,900,000 in FYs 2/3/4 No estimate

*FWS acquisition funds are shown in this schedule in the FY they are anticipated, and are included in the funding summary. Other agency costs for acquisition are not shown either here or in the summary.

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
M-3	Provide for protection of manatees in management plans on state and federal lands	232	1	Continuing	FWS FDNR FGC NPS GDNR MMC	2					Routine Routine Routine Routine Routine
O-4	Designate additional areas as "Critical Habitat"	233	3	1 year	FWS FDNR MMC						If necessary/ See 2221 If necessary/ See 2221 If necessary/ See 2221
M-3	Establish and expand a network of manatee "reserves" and protected connecting travel corridors	234	1	Continuing	FWS FDNR MIA FDCA FDER LOCAL GOV'TS GDNR						Routine Routine Routine Routine Routine Routine Routine
M-3, R-12	Protect and monitor quality and quantity of water flowing from natural springs	235	1	Continuing	WMDs FDER						No estimate Routine
M-3	Protect integrity of artificial effluents as important refugia	236	1	Continuing	FWS FDNR GDNR IND./UTILITY						Routine Routine Routine Routine
M-3	Protect and maintain integrity of coastal ecosystems	237	1	Continuing	FWS COE FDER FDCA FDNR WMDs LOCAL GOV'TS CZM RPCs GDNR						Routine Routine Routine Routine Routine Routine Routine Routine Routine Routine

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
M-3	Maintain, protect, and monitor water quality and vegetation	238	1	Continuing	LOCAL GOV'TS FDER COE FWS FDNR EPA CZM WMDs RPCs GDNR						No estimate Routine Routine Routine Routine No estimate No estimate No estimate No estimate No estimate
M-3	Properly locate boating facilities and navigational channels	239	1	Continuing	LOCAL GOV'TS FDCA FDER COE FWS FDNR USCG MIA GDNR						No estimate Routine Routine Routine Routine See 2232 No estimate See 121 No estimate
M-2,3	Manage habitats for enhancing use by manatees	24	3	Continuing	FWS FDNR						Routine on NWRs Routine
R-14, M-7	Minimize harassment/disturbance by boat/barge traffic	311	2	Continuing	FWS FDNR LOCAL GOV'TS USCG MIA						Routine Routine No estimate No estimate See 121
R-14, M-7	Minimize harassment by divers and swimmers	312	2	Continuing	FWS FDNR LOCAL GOV'TS						Routine/ on NWRs Routine No estimate
R-14, M-7	Minimize harassment from fishing-related activities	313	2	Continuing	FWS FDNR LOCAL GOV'TS MFC FGC RPCs						Routine/on NWRs Routine No estimate No estimate No estimate Routine

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
0-1,2	Evaluate/expand educational programs and enforcement to reduce harassment	314	2	Continuing	FWS FDNR LOCAL GOV'TS SMC FPL MIA	25	27	29	31	33	See 171 See 171 No estimate Routine Local MIA participation
R-1,6; M-7	Use aerial survey techniques to monitor general patterns of distribution and relative abundance	41	1	Continuing	FWS FDNR SMC FPL LOCAL GOV'TS GDNR	5 65 14 20 0	5 80 14 20 16	10 90 15 20 16	7 100 16 21 16	7 120 16 22 16	No estimate
R-1,6	Designate working group to improve communications about and standardization of current population survey methods	411	2	1 year	FWS FDNR MIA GDNR						Routine Routine Routine Routine
R-1	Evaluate available population/survey information annually	412	2	Continuing	FWS FDNR MIA GDNR						Routine Routine Routine Routine
R-1	Refine methods to monitor status of manatee populations	42	1	Continuing	FWS FDNR	40	40				See 41 Also see 41
R-1,6; M-7	Develop/evaluate aerial survey methods for estimating/indexing manatee abundance in management areas and ultimately, statewide	421	1	Continuing	FWS FDNR GDNR						See 41, 42 See 41, 42 See 41

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
R-1	Evaluate utilization of mark/recapture methodology for estimating populations	422	2	3 years	FWS FDNR	10	20	40	60	80	Routine
R-6	Continue assessment of vital parameters (size, age, etc.) of manatee populations in certain areas	431	2	Continuing	FWS FDNR	25 5	25 10	27 10	30 15	30 20	
R-1, M-7	Develop/utilize population modeling	432	1	Continuing	FWS FDNR	0 15	10 35	10 35	5 10	5 10	
R-1	Expand assessment of manatee population genetics	433	2	2 years	FWS FDNR MMC	0 0 5	30 15	30 15	0 0	0 0	
R-6	Continue development of aging techniques	434	2	Continuing	FWS FDNR MMC	5					No estimate No estimate
R-6	Continue long-term studies on social structure and behavior using radio telemetry	435	2	Continuing	FWS FDNR	5 0	30 30	30 30	30 30	30 30	
R-6	Conduct studies with captive and free ranging manatees	436	3	Continuing	FWS FDNR OCEANARIA	5	15	20	30	30	No estimate No estimate
R-14, M-7	Maintain/expand captive research program and facilities	44	2	Continuing	FWS FDNR OCEANARIA	25	25	25	25	25	No estimate Homosassa Facility No estimate

IMPLEMENTATION SCHEDULE

West Indian (Florida) manatee (Recovery Priority #6C)

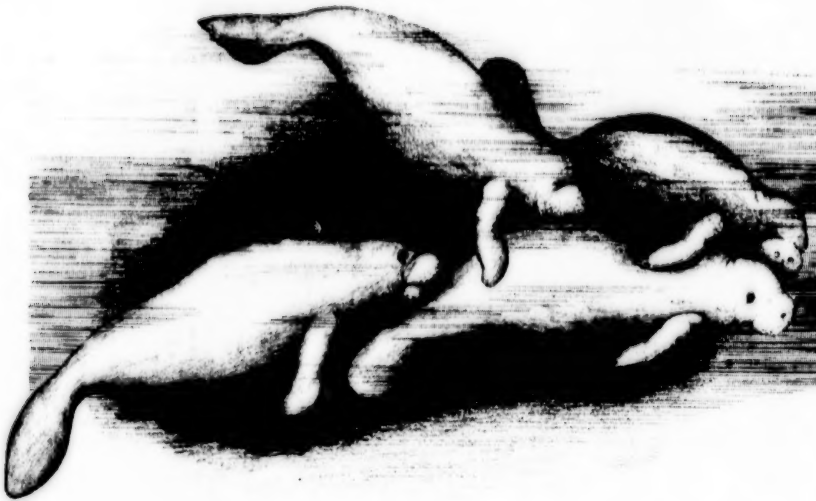
General Category	Plan Task	Task Number	Priority	Task Duration	Responsible Agency	Current*	Est. Fiscal Year Costs				Comments/ Notes
							FY 2	FY 3	FY 4	FY 5	
M-7, 0-4	Maintain State and Federal manatee coordinator positions	51	2	Continuing	FWS FDNR GDNR	45 45	45 45	45 45	45 45	45 45	No estimate
M-7, 0-4	Maintain Recovery Team and FDNR's Technical Advisory Council	52	2	Continuing	FWS FDNR COE MMC FDER FDCA GDNR MIA SMC FPL OCEANARIA SIERRA WMDs	4					Routine Routine Routine Routine Routine Routine Routine Routine Routine Routine Routine Routine
M-7, 0-4	Update Recovery Plan	53	2	Every 5 years	FWS WITH ASSISTANCE OF RECOVERY TEAM						Routine
M-7, 0-4	Develop Annual Work Plans	54	2	Continuing	RECOVERY TEAM & AGENCIES						Routine
M-7, 0-4	Publish Annual Report	541	3	Annually	RECOVERY TEAM						Routine

*Current = Funds currently included in agency budget

*Routine = Funds currently in agency base budget that do not lend themselves to being separated out or are included in another task.

*FY2 - FY5 = Expected base funding available + unfunded need.

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APPENDIX A

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APPENDIX B.

Summary of Comments and Recovery Team Responses

The revised Florida Manatee Recovery Plan was drafted by the Florida Manatee Recovery Team, and distributed to approximately 140 individuals and organizations for technical review on November 2, 1988. On March 2, 1989, news releases were sent to the major newspapers in Florida and coastal Georgia advising the public that the draft plan would be available for review through April 10, 1989. Primarily because of the coordination and cooperation received from the involved agencies, numerous groups, and knowledgeable individuals during development of the plan, only 21 comments were received.

All comments that were received supported the plan and recovery efforts. Recommendations for changes ranged from a few simple editorial changes and corrections, to specific points of concern. These recommendations and suggestions were carefully reviewed by the Recovery Team, and incorporated into the plan as appropriate.

The following discussions provide a narrative summary of responses from the Recovery Team to the few suggested changes that were not made.

1. **Comment:** Several reviewers noted that the plan's format needed to be modified to avoid repetition, redundancy, and duplication. For example, it was suggested that the step-down outline be eliminated since tasks were subsequently repeated in the Narrative Section.

Response: Although these comments were worthwhile and deserving of implementation, the Preface notes that the Recovery Team was required to follow the standardized format for developing the plan.

2. **Comment:** Some reviewers were concerned that tasks were being delegated without commitment and/or guarantee of cooperation.

Response: By endorsing the plan, the identified agencies and groups have cooperatively agreed to support identified responsibilities. However, guaranteed implementation of tasks will be contingent upon adequate appropriations and available staff as noted in Section III.

3. **Comment:** There were several comments relative to the assigned task priorities in the implementation schedule.

Response: Numerous changes were repeatedly made by the Recovery Team. The present assigned numbers should accurately reflect priority ranking as based on the guidance provided on page 78. It should be noted that these priorities do not necessarily indicate the order tasks will be accomplished.

4. Comment: Several reviewers requested that the Introduction Section be expanded to include more detailed information and maps on abundance, distribution, important feeding areas, locations of existing boat regulatory speed zones and sanctuaries, movement patterns, etc.

Response: The Recovery Team agreed that the plan's Introduction Section was adequate, and that the cited literature and selected references in Appendix A would provide additional detail for those requiring more information.

5. Comment: There was some concern that many needed basic biological studies were not receiving adequate emphasis, and that management actions were being implemented without solid data. Specifically, it was suggested that more emphasis be directed towards independent manatee research.

Response: Recommended management actions will be based on the best available biological information. Additional biological research by both government and outside researchers has been recommended throughout the plan. Research by independent sources has not been deemphasized or rejected, and some changes were made in the appropriate sections to reiterate this fact. However, it should be noted that all scientific research on endangered marine mammals overseen by the Department of Interior must be done under a permit granted by the Federal Wildlife Permit Office, following review by the agency and by the independent U.S. Marine Mammal Commission and their Committee of Scientific Advisors (no FWS or State manatee biologists are on the committee). Approval or rejection of the research is based on quality and appropriateness of the proposal as perceived by the committee. It is not an arbitrary process.

Summary

The Recovery Team recognizes that the revised recovery plan for the Florida manatee may not entirely meet the satisfaction and approval of all parties and organizations. However, it is felt that the plan accurately reflects the basic problems associated with the Florida manatee, and presents an orderly, workable plan of action that can be implemented to accomplish recovery of the species. Successful recovery efforts will require the cooperation and assistance of the many involved entities working together.

END

DATE FILMED

11-19-91